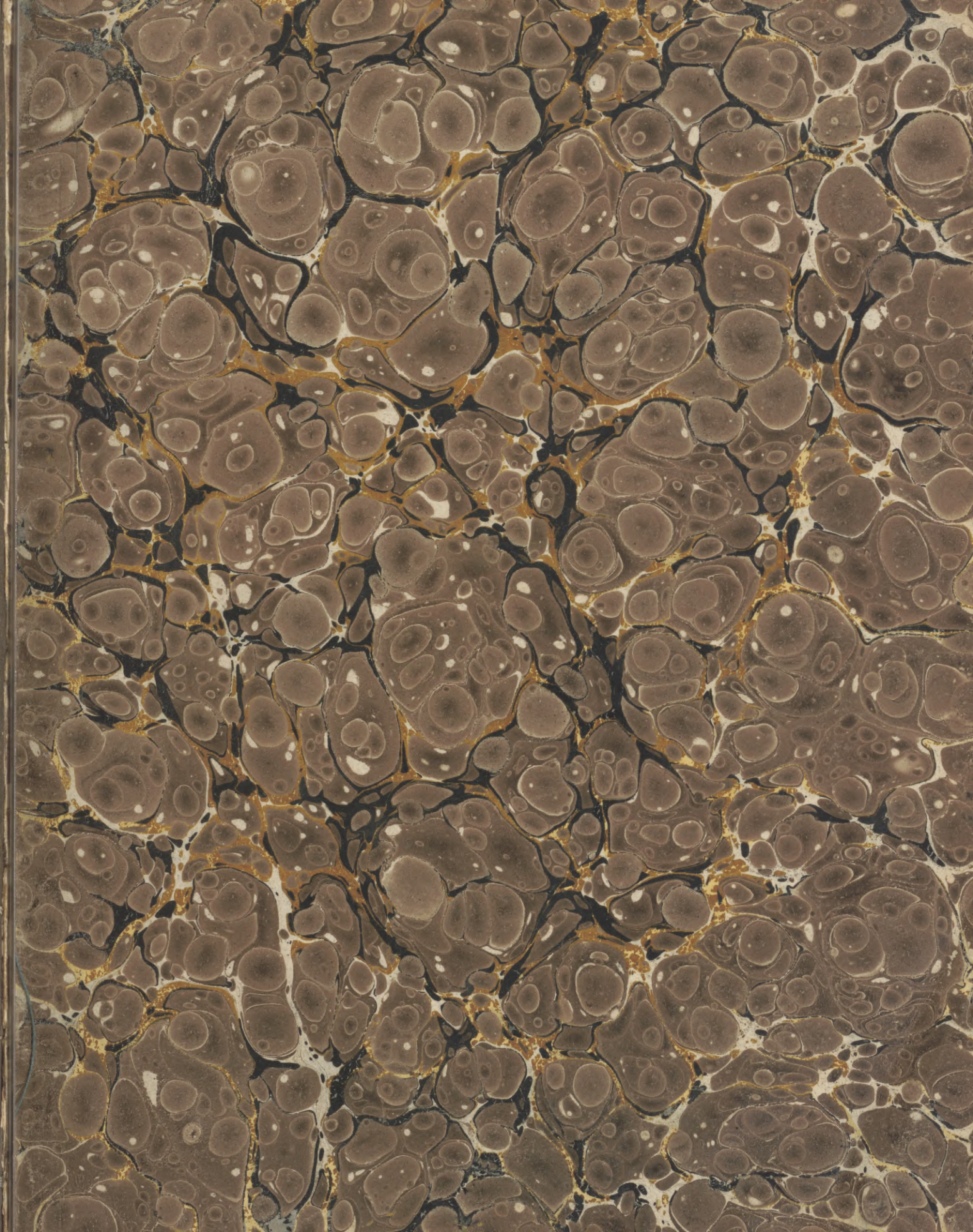




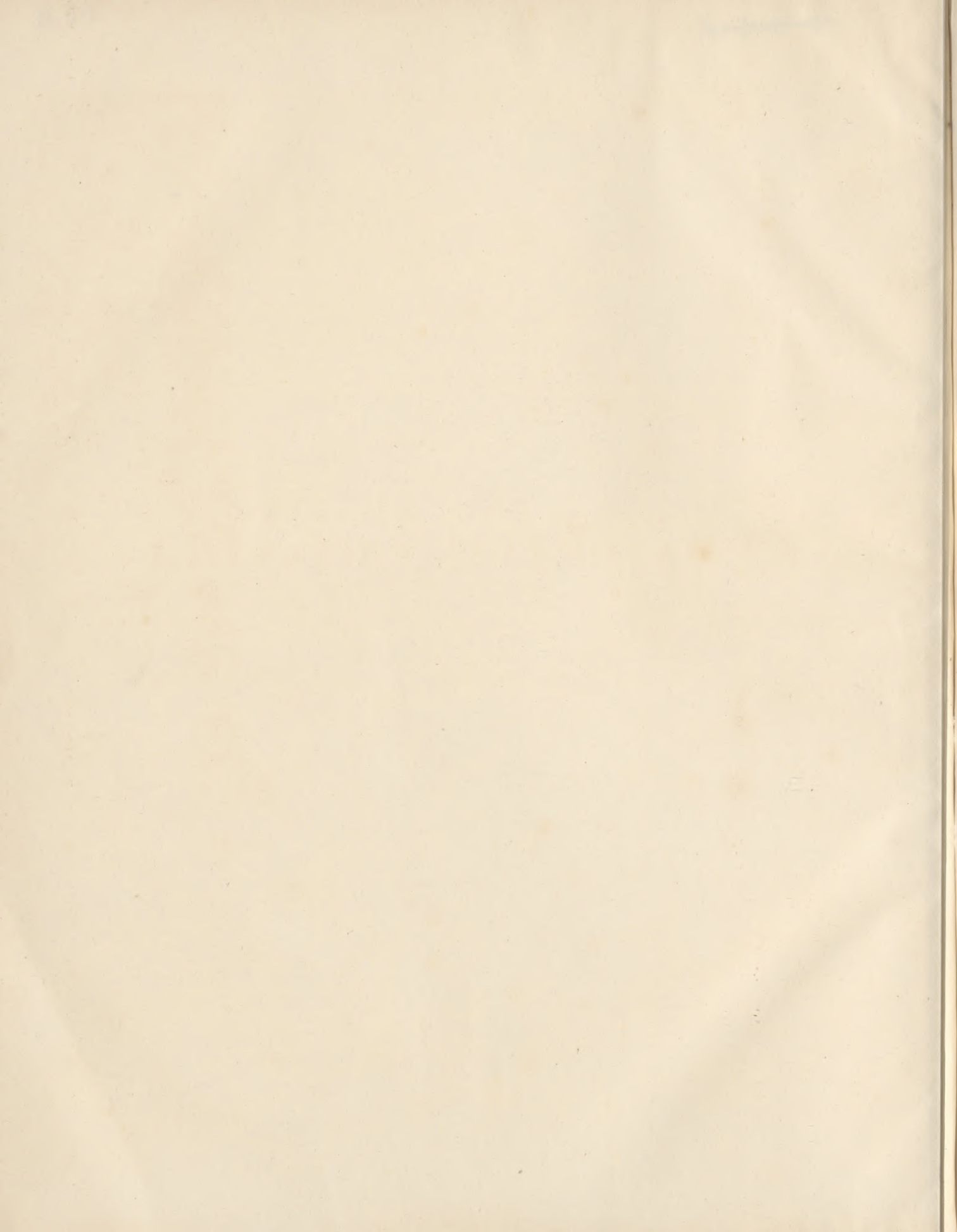
John Walton.



~~X. 205 b.~~



THE GREAT EASTERN



ENCYCLOPÆDIA BRITANNICA.

ENCYCLOPEDIA BRITANICA.





Encyclopædia Britannica:

OR, A

DICTIONARY

OF

ARTS, SCIENCES, AND MISCELLANEOUS
LITERATURE;

ENLARGED AND IMPROVED.

THE SIXTH EDITION.

Illustrated with nearly six hundred Engravings.

VOL. I.

INDOCTI DISCANT; AMEN MEMINISSE PERITI.

EDINBURGH:

PRINTED FOR ARCHIBALD CONSTABLE AND COMPANY;

AND HURST, ROBINSON, AND COMPANY, 90, CHEAPSIDE,

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1823.



PREFACE TO THE FIFTH EDITION.

THE importance of a work so constructed as to exhibit a comprehensive and accurate view of every branch and portion of human knowledge, and human art, must be too apparent to require any illustration. Such is the intention of the *ENCYCLOPÆDIA BRITANNICA*; and the publication of *five* extensive editions of a work devoted to such objects, at once affords a proof of its eminent utility, and of the favourable opinion of the public as to the ability with which it has been executed.

The great superiority of the plan of this work has contributed in no small degree both to its usefulness and popularity. A very few words will serve to explain the principles, and to evince the pre-eminence of the method which its compilers have pursued in treating the various branches of the arts and sciences.

In all former attempts, the alphabet, in place of being employed in the humble function of an index to the matter contained in the work, was made supreme arbiter of the whole arrangement; and the different sciences, instead of being made the subjects of distinct and connected discussion, were cut down into detached parts, out of which no general view of any one science or art could possibly be formed. In this view, the alphabet, far from conducing to clearness, became an instrument of disorder; and its only use appeared to be, to save the trouble of a more commodious or philosophical arrangement. These obvious defects in all the most popular Dictionaries of arts and sciences were clearly observed by Mr Chambers, himself the compiler of a well-known work of this kind; and, in speaking of the labours of his predecessors, he particularly censures the uninstructional method of their performances. "Former lexicographers (he observes) scarce attempted any thing like structure in their works; they seem not to have been aware that a dictionary is in some measure capable of the advantages of a *continued discourse*; and hence it is, that we see nothing like a *whole* in what they

have done." For the purpose of remedying this defect in his own work, he informs his readers, that "his view was to consider the several matters, not only in themselves, but relatively, or as they respect each other; both to treat them as so many wholes, and as so many parts of some greater whole; and to point out their connection with each other, and with that whole, by reference: so that by a course of references from generals to particulars, from premises to conclusions, from cause to effect, and *vice versa*, a communication might be opened between the several parts of the work, and the detached articles be in some measure replaced in the natural order of science, out of which the alphabetical order had removed them." And in order to exhibit a view of the bearings and relations of the various articles scattered through his Dictionary, he has prefixed to it a tabular analysis illustrative of their mutual connections and dependencies.

But although it must be admitted, that this table is elaborately and skilfully constructed, and that the arrangement of the Cyclopædia of Mr Chambers is much preferable to that of any former work of the kind, it is still indisputably liable to many of those very objections for which this author censures his predecessors. Even if his original plan had been carried into effect with complete success, and all the articles in different parts of his work had been so managed, as, when reunited, to have made so many complete systems, the number of references was still so great, that no reader could possibly have submitted to the trouble of combining them. (A).

Of this inconveniency the original compilers of the ENCYCLOPÆDIA BRITANICA were fully aware; and they resolved, in the conduct of their work, to adopt such a plan as should completely free it from this objection. They were as fully convinced as their predecessors of the utility of a separate explanation of every technical term, and of the necessity also of noticing, in detail, many topics which it would be proper more fully to illustrate in a general account of the respective sciences to which they belonged. But without such general tréatisses, combining
in

(A) Thus, from METEOROLOGY we are referred to AIR and the ATMOSPHERE; including, 1st, The history of its contents, ÆTHER, FIRE, VAPOUR, EXHALATION, &c.; 2d, METEORS formed therein; as CLOUD, RAIN, &c. SHOWER, DROP, SNOW, HAIL, DEW, DAMP, &c. RAINBOW, PARHELION, HALO, THUNDER, WATER-SPOUT, WINDS, MONSOON, HURRICANE, and the like. And as every word printed in capitals is the title of an article treated separately in the Cyclopædia, we must turn backwards and forwards through more than twenty-four references before we come at the detached topics, which we are directed to unite into a system of METEOROLOGY. The number of articles which must be united in the same manner to constitute the Compiler's system of METAPHYSICS is upwards of forty-eight; and those which are referred to THEOLOGY above three hundred!

in one view all the related parts of a subject, they deemed it impossible to convey any thing like complete or philosophical information. They accordingly endeavoured, in so far as their limits would permit, to exhibit a clear and satisfactory account of the several arts and sciences under their proper denominations, and to explain, at the same time, the subordinate articles, under their technical terms. These articles may be divided into three kinds. The first consists of such as, not depending very closely on particular systems, admit of a complete explanation under their proper names; the second, of such as require to be considered in the general account of the sciences with which they are connected, and also under their own denominations; and the third, of such as belong to a great whole, from which they cannot be separated, so as to be explained in detail. Articles of the first kind admit, of course, of no references; those of the second sort, being only partially explained under their own denominations, the reader is referred for more complete information to the article where the subject is more fully illustrated; and in articles of the third description, no attempt is made to explain them, except in connection with the subjects to which they severally belong, and to which the reader is always therefore referred.

Such is the plan of arrangement adopted in the first, and followed, with some improvements in the detail, throughout every edition of the *ENCYCLOPÆDIA BRITANNICA*; and there appears to be no other, by which the great objects of such a work could be so conveniently and completely attained. Indeed, it seems to be now pretty generally admitted, in this country at least, that the best form which can be given of this kind of Dictionary, is that in which the several arts and sciences are digested into treatises, and the various subordinate and detached parts of knowledge explained in the order of the alphabet.

In the first edition of the *ENCYCLOPÆDIA BRITANNICA*, its compilers seem to have intended little more than to furnish a general Dictionary 'of Arts and Sciences'; but in the succeeding edition, they took a wider range, so as to include the great departments of Geography, History, Biography, and General Literature. In this way, the work was converted into a Pandect and Repository of universal knowledge; and from three volumes, the form in which it first appeared, has been gradually extended to a size more commensurate to the magnitude and variety of its objects.

Of the *first* and *second* editions of this work, and the twelve first volumes of the *third*, it is understood, that Mr Colin Macfarquhar, one of its original proprietors and projectors, was the principal editor. Owing to his death, the remaining six volumes of the third edition were edited by the Reverend Dr Gleig. This gentleman was peculiarly fortunate, in being honoured with the co-operation

operation of the late Professor John Robison, whose contributions to the latter volumes of that edition were numerous, and tended essentially to enhance the character and utility of the undertaking. The fourth edition was wholly edited by Dr James Miller, under whose superintendence, and with the assistance of several able contributors, the work received a large addition of new articles and treatises in all its departments.

To enumerate all the contributors to a work which has undergone so many changes, and of the compilation of which in its successive stages no record has been preserved, is now beyond any means of information which either the publishers or any others possess. But they can still afford this satisfaction in regard to almost all the more valuable treatises which it contains.

The article Agriculture, which, it seems probable, was originally compiled by the late Mr James Tytler, was re-arranged and improved for the fourth edition by Robert Forsyth, Esq. advocate. The treatise on Anatomy, originally drawn up by Mr Andrew Fyfe of the University of Edinburgh, was revised by Dr Millar. Acoustics, Aerostation, and Gunnery, were compiled by Mr Tytler. The new discoveries in Acoustics and Aerostation were added by Dr Millar. Astronomy, compiled also by Mr Tytler for the third edition, from materials furnished by Mr Jones of London, was more scientifically arranged, with the addition of the later discoveries, for the *fourth*. Blind was furnished by Dr Blacklock and Dr Moyes. Education, Religion, and Society, were composed by Mr Robert Heron. The lives of Johnson and Mary Queen of Scots, with Instinct, Love, Metaphysics, Miracle, the history of Ethics under Moral Philosophy, Oath, Passion, Plastic Nature, Polytheism, Prayer, Slavery, and Supper of the Lord, were contributed by Dr Gleig; Grammar and Theology by the Reverend James Bruce and Dr Gleig; and Motion by Dr Gleig and Mr Tytler. Medicine, originally written by Dr Duncan, senior, of the University of Edinburgh, was revised by him for the fourth edition. The article Music was partly drawn up by Dr Blacklock, and revised for the fourth edition by George Sandy, Esq. The *historical* part of this article, originally written by William Maxwell Morison, Esq. advocate, was revised and continued down to the publication of the fourth edition, by the same gentleman, who also furnished the treatise on Physiognomy. Mysteries, Mythology, and Philology, were drawn up by the late Dr Doig of the grammar school of Stirling. Navigation, Parallax, Pendulum, Projection of the Sphere, and Ship-Building, were furnished by the late Dr Mackay of Aberdeen. Optics, which was drawn up by Mr Jones, and revised for the third edition by the late Professor Robison, was subjected to another revision for the fourth edition by Dr Brewster. Percussion, Perspective, Philosophy, Physics, Pneumatics,
Precession

Precession of the Equinoxes, Projectiles, Pumps, Quantity, Resistance of Fluids, River, Roof, Rope-making, Rotation, Seamanship, Signals, Simson (Robert, life of,) Smoke-jack, Specific Gravity, Spirituous Liquors, Statics, Steam and Steam Engine, Stove (the addition to this article in the fourth edition by Dr Millar), Strength of Materials, Telescope, Tide, Articulating Trumpet, Variation of the Compass, and Water-Works, were contributed by Professor Robison. Predestination and Providence were furnished by Mr Forsyth; the History of the French Revolution by the same gentleman and Dr Gleig; and the Continuation in the fourth edition by Dr Millar.

All the preceding articles were written for editions prior to the *fourth*, in which they only received the improvements or additions which have been respectively specified. The following articles and treatises were contributed, for the first time, to the fourth edition :

Algebra, Conic Sections, Fluxions, Geometry, Logarithms (description of), Mensuration, Porism, Series, and Trigonometry, by Mr Wallace, one of the mathematical professors in the Royal Military College at Sandhurst. Hydrodynamics, Free-Masonry, *history* of Mathematics, and Mechanics, by Dr Brewster of Edinburgh. Ichthyology, Meteorolite, Ophiology, and Ornithology, by Mr Muirhead, professor of natural history in the university of Glasgow. Africa, Asia, and Europe, with the *continuation* of the history of America, and of Britain, by Robert Forsyth, Esq. advocate. Electricity, Farriery, Geography, Geology (part of), Magnetism, Mammalia, Man, Materia Medica, Physiology, Prescriptions (extemporaneous), Russia, Science (amusements of), Scotland (geographical and statistical parts), Spain, War (*introduction*), and Zoophytes, by Dr Kirby of Edinburgh. *Continuation* of the history of India, by the late Dr William Tennant. Life and philosophy of Boscovich, by Dr Poole of Edinburgh. Entomology, by Mr James Williamson of Edinburgh. Midwifery, by Dr Hamilton, junior, professor of midwifery, Edinburgh. Surgery, by James Wardrop, Esq. surgeon, London. Vegetable Physiology, by Mr Lyall, surgeon, Paisley. Political Economy and Taxation, by Mr Hugh Murray of Edinburgh. Cetology, Chemistry, Conchology, Crystallization, Dyeing, Erpetology, Furnace, Galvanism, Geology (part of), Mineralogy, Ores (analysis and reduction of), Stones (analysis of), and the continuation of Galvanism under the word Zinc, by Dr Millar.

The favourable reception of the fourth edition encouraged the then proprietor to proceed with a reprint, which had advanced to the sixth volume, before the copyright was acquired by the present publishers. They were thereby precluded from making any material alterations on the present or *fifth* edition; but as the work

work, after it became their property, was subjected to a revision by the former editor (Dr Millar), many errors and inaccuracies have been corrected; and the improvement of the plates has given it a decided superiority in this capital department over every former edition. The SUPPLEMENT VOLUMES, with which it is to be followed, will enrich its stock of miscellaneous information with a large accession of interesting articles; and, presenting a view of the arts and sciences in their latest state of improvement at home and abroad, will thus render the *ENCYCLOPÆDIA BRITANNICA* the most complete repertory of universal knowledge that has yet been given to the public.

Edinburgh, 1st December, 1817.

ADVERTISEMENT
TO
THE SIXTH EDITION.

IN bringing out a New Edition of the *ENCYCLOPÆDIA BRITANNICA*, the Publishers deem it unnecessary either to enlarge on the utility of such works in general, or to dwell on the peculiar merits of that with which they are more immediately concerned, whose established reputation precludes the necessity of any formal eulogium. The plan of the Work having been described, and the history of its progress detailed, in the Preface to the Fifth Edition, which is now reprinted and subjoined, it is only necessary here to give an account of the alterations and improvements introduced into the present Edition.

In correcting and revising this Edition, it was necessary to keep in view the additional matter contained in the *SUPPLEMENT*, now in course of publication. Scientific articles, relating to subjects upon which there are new treatises in that work, have received few alterations; but others, which seemed to require it, have been revised by gentlemen acquainted with the respective subjects. The Historical articles have been extended, so as to embrace an outline of all the recent memorable public transactions in both hemispheres. Most of the Geographical articles have been carefully revised, and some of them altogether rewritten. This department will be found to contain, besides several entirely new articles, a great body of additional statistical details, derived from the census of 1811 and other sources; and all the great changes introduced by the Congress of Vienna in 1815, and subsequent diplomatic arrangements, have been attended to, under the heads to which they refer. But what will be found to give a peculiar value to the present Edition, the titles of all the articles (hitherto published) in the *SUPPLEMENT*, have been inserted at their proper places in the Alphabetical order, while numerous references of a more general kind have been introduced.

Edinburgh, January 1822.

ADVERTISEMENT

TO

THE SIXTH EDITION

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Edinburgh, January 1822.

ENCYCLOPÆDIA BRITANNICA.

A.

A. **A**, THE first letter of the alphabet, in all the known languages of the world, that of Ethiopia excepted, in which it is the 13th. It has deservedly the first place in the alphabet, on account of its simplicity, very little more being necessary to its pronunciation than opening the mouth.

In the English language, A is the mark of three different sounds, termed, by our grammarians, the *broad*, the *open*, and the *slender* A. The first resembles that of the German A, is found in several monosyllables, as *wall*, *salt*, &c. and is pronounced as *au* in *cause*. It is probable that the Saxons expressed only this broad sound of the letter, as it is still commonly retained in the northern districts of England, and universally throughout Scotland; as, *tauk* for *talk*, *wauk* for *walk* or *wake*.—The open A resembles that of the Italians in *adagio*, and is the same with that of a in *father*, rather, &c. The slender sound is peculiar to the English language, and resembles the sound of the French diphthong *ai* in *pais*, or their *a* masculine, or perhaps it is a middle sound between them. This is exemplified in *place*, *waste*, &c. also in *toleration*, *justification*, and all other words ending with *ation*.

A is sometimes added after words in burlesque poetry; in which case it only makes an additional syllable without any alteration of the sense, as the interjection O very often does in our ballads. It is also sometimes redundant, as in the words *arise*, *awake*, &c. which are not different in signification from *rise*, *wake*, &c.

It is sometimes a word, either noun or interjection; in which last case, it is commonly an expression of grief, and joined with the aspirate, as *ah!* When a noun, it is only with respect to itself; as *great A*, *little a*, &c.

A is very frequently used as an article; in which case it has no plural signification, and is used to denote the number *one*, as *a* house, *a* field, &c. When placed as an article before any of the vowels, *y* and *w* only excepted, it is joined with the letter *n*; as *an* island, *an* orator, &c.—In the three following cases it is a preposition: 1. When it goes before a participle, or noun derived from a participle; as, I am *a* doing this or that. 2. When used before local surnames; as *Cornelius a Lapide*, *Thomas a Kempis*, &c. 3. When it is used in composition; as, *a* foot, *a* sleep, &c. In some instances it denotes the proportion of one thing to another; as, so much *a* week, *a* man, *a* head, &c.

A, among the ancients, was a numeral letter, and

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signified 500; and when a dash was added on the top A, 5000.

A, in the Julian calendar, is the first of the seven DOMINICAL letters. It had been in use among the Romans long before the establishment of Christianity, as the first of the eight *nundinales literæ*; in imitation whereof it was that the dominical letters were first introduced.

A is also an abbreviation used with different intentions. Hence,

A, among logicians, is used to denote an universal affirmative proposition; according to the verse,

Asserat A, negat E, verum generaliter ambæ.

Thus, in the first figure, a syllogism consisting of three universal affirmative propositions, is said to be in *Bārbarā*; the A thrice repeated, denoting so many of the propositions to be universal, &c. See BARBARA.

A, among the Romans, was used in giving votes or suffrages.—When a new law was proposed, each voter had two wooden ballots put into his hand; the one marked with a capital A, signifying *antiquo*, q. d. *antiquam volo*; and the other with U. R. for *uti rogas*. Such as were against the law, cast the first into the urn; signifying I refuse it, I antiquate it; or, I like the ancient law, and desire no innovation.

A, in the trials of criminal causes, also denoted absolution: Whence Cicero, *pro Milone*, calls A, *litera salutaris*, a saving letter.—Three ballots were distributed to each judge, marked with the letters, A for *absolvo*, I acquit; C for *condemno*, I condemn; and N. L. for *non liquet*, It is not clear. From the number of each cast into the urn, the prætor pronounced the prisoner's fate. If they were equal in number, he was absolved.

A, in the ancient inscriptions of marbles, &c. occasionally stands for *Augustus*, *ager*, *aiunt*, &c. When double it denotes *Augusti*; when triple *aurum*, *argentum*, *æs*; and sometimes its meaning can only be known by the rest of the inscription. Isidore adds, that when it occurs after the word *miles*, (soldier), it denotes him young. On the reverse of ancient medals, it denotes that they were struck by the city of Argos, sometimes by that of Athens; but on coins of modern date, it is the mark of Paris.

A, as an abbreviation, is also often found in modern writers: as A. D. for *anno Domini*; A. M. *artium magister*, master of arts; *anno mundi*, &c.

A

A,

A
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Aaron.

A, the letter a, with a line above it, thus \bar{a} , is used in medical prescriptions for *ana*, of each; sometimes it is written thus, $\bar{a}\bar{a}$: e. g. \bar{B} . Mel. Sacchar. et Mann. \bar{a} , vel $\bar{a}\bar{a}$, \bar{z} j. i. e. Take of honey, sugar, and manna, of each, one ounce.

A, put to bills of exchange, is in England an abbreviation of *accepted*, and in France for *accepte*. It is likewise usual among merchants to mark their sets of books, with the letters A, B, C, &c. instead of the numbers 1, 2, 3, &c.

A.A.A. The chemical abbreviation for Amalgama, or Amalgamation.

AA, the name of several rivers in Germany and Switzerland.

AACH, a little town of Germany, in the circle of Suabia, near the source of the river Aach, and almost equally distant from the Danube and the lake Constance. It belongs to the house of Austria. E. Long. 9. o. N. Lat. 47. 55.

AAHUS, a little town of Germany, in the circle of Westphalia and bishopric of Munster. It is the capital of Aahus, a small district; has a good castle; and lies north-east of Coesfeldt. E. Long. 7. 1. N. Lat. 52. 10.

AAM, or HAAM, a liquid measure in common use among the Dutch, containing 128 measures called *mingles*, each weighing nearly 36 ounces avoirdupois; whence the *Aam* contains 288 English, and 148 $\frac{2}{3}$ pints Paris measure.

AAR, the name of two rivers, one in Switzerland, and another in Westphalia in Germany. It is also the name of a small island in the Baltic.

AARASSUS, in *Ancient Geography*, a town of Pisidia, in the Hither Asia, thought to be the Anassus of Ptolemy.

AARON, high-priest of the Jews, and brother to Moses, was by the father's side great grandson, and by the mother's grandson of Levi. By God's command he met Moses at the foot of Mount Horeb, and they went together into Egypt to deliver the children of Israel: he had a great share in all that Moses did for their deliverance. The Scriptures call him the prophet of Moses, and he acted in that capacity after the Israelites had passed over the Red sea. He ascended Mount Sinai with two of his sons, Nadab and Abihu, and seventy elders of the people; but neither he nor they went higher than half way, from whence they saw the glory of God; only Moses and Joshua went to the top, where they staid forty days. During their absence, Aaron, overcome by the people's eager entreaties, set up the golden calf, which the Israelites worshipped by his consent. This calf has given rise to various conjectures. Some rabbies maintain that he did not make the golden calf, but only threw the gold into the fire, to get rid of the importunities of the people; and that certain magicians who mingled with the Israelites at their departure from Egypt, cast this gold into the figure of a calf. According to some authors, the fear of falling a sacrifice to the resentment of the people, by giving a refusal, made Aaron comply with their desire: and they allege also that he hoped to elude their request, by demanding of the women to contribute their ear rings, imagining they would rather choose to remain without a visible deity, than be deprived of their personal ornaments. This affair of the golden calf happened in the third month after the Is-

raelites came out of Egypt. In the first month of the following year, Aaron was appointed by God high-priest; which office he executed during the time that the children of Israel continued in the wilderness. He died in the fortieth year after the departure from Egypt, upon Mount Hor, being then 123 years old; A. M. 2522, of the Julian period 3262, before the Christian era 1452.

AARON, the Carait, a learned Jew who flourished about the year 1299. He left many works on the Old Testament, among which there is one entitled, "A Commentary on the Pentateuch," which has been much valued. It was written in Hebrew, and printed in folio with a Latin translation, at Jena, in 1710.

AARON, another Carait Jew, who lived in the 15th century, wrote a concise Hebrew grammar, entitled *Chelil Jophi*, "the Perfection of Beauty," which was printed at Constantinople in 1581.

AARON and JULIUS, *Saints*, were brothers who suffered martyrdom together, during the persecution under the emperor Dioclesian, in the year 303, about the same time with St Alban the first martyr of Britain. We are not told what their British names were, it being usual with the Christian Britons, at the time of baptism, to take new names from the Greek, Latin, or Hebrew. Nor have we any certainty as to the particulars of their death; only that they suffered the most cruel torments. Two churches were dedicated to the brothers, in which their bodies were interred, at Caerleon, the ancient metropolis of Wales.

AARON, or *Harun*, *Al Raschid*, a celebrated caliph, or Mahometan sovereign of the Saracen empire; whose history is given under the article BAGDAD.

AARSENS, FRANCIS, Lord of Someldyck and Spyck, was one of the greatest ministers for negotiation the United Provinces could ever boast of. His father, Cornelius Aarsens, was register to the States; and being acquainted with Mr Plessis Mornay, at the court of William prince of Orange, he prevailed upon him to take his son under him, with whom he continued some years. John Olden Barneveldt, who presided over the affairs of Holland and all the United Provinces, sent him afterwards agent into France, where he learned to negotiate under those profound politicians Henry IV. Villeroy, Silleri, Rossie, Jaonin, &c. and he acquitted himself in such a manner as to obtain their approbation. Soon after, he was invested with the character of ambassador, and was the first who was recognized as such by the French court; at which time Henry IV. declared, that he should take precedence next to the Venetian minister. He resided in France 15 years; during which time he received great marks of esteem from the king, who created him a knight and baron; and for this reason he was received among the nobles of the province of Holland. However, he became at length so odious to the French court, that they desired to have him recalled. He was afterwards deputed to Venice, and to several German and Italian princes, upon occasion of the troubles in Bohemia. He was the first of three extraordinary ambassadors sent to England in 1620, and the second in 1641; in which latter embassy he was accompanied by the lord of Brederode as first ambassador, and Heemsvliet as third, to negotiate the marriage of Prince William, son of the Prince of Orange, with a daughter.

Aaron
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Aarsene.

Aarsens
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Aba.

daughter of Charles I. He was likewise ambassador extraordinary at the French court in 1624, at the beginning of Cardinal Richlieu's administration, who had a high opinion of him. The memoirs which he has left, of the negociations in which he was engaged, show him to have been one of the ablest men of his time, and worthy of the confidence and trust reposed in him by his country. But his character is not altogether without stain. His enmity to the remonstrants was bitter and unrelenting; and he is supposed to have greatly encouraged the violent measures pursued by Prince Maurice against the venerable Barneveldt, and to have been the principal adviser for assembling the famous and persecuting synod of Dordrecht. He died at a very advanced age; and his son, who survived him, was reputed the wealthiest man in Holland.

AASAR, in *Ancient Geography*, a town of Palestine, in the tribe of Judah, situated between Azotus and Ascalon. In Jerome's time it was a hamlet.

AB, the eleventh month of the civil year of the Hebrews, and the fifth of their ecclesiastical year, which begins with the month Nisan. It answers to the moon of July; that is, to part of our month of the same name, and to the beginning of August: it consists of thirty days. The Jews fast on the first of this month, in memory of Aaron's death; and on the ninth, because on that day both the temple of Solomon, and that erected after the captivity, were burnt; the former by the Chaldeans, and the latter by the Romans. The same day is also remarkable among that people for the publication of Adrian's edict, wherein they were forbidden to continue in Judea, or even to look back when at a distance from Jerusalem, in order to lament the desolation of that city. The 18th of the same month is also a fast among the Jews; because the lamp in the sanctuary was that night extinguished, in the time of Abaz.

AB, in the Syriac calendar, is the name of the last summer month. The first day of this month they called *Suum-Miriam*, the fast of the virgin, because the eastern Christians fasted from that day to the fifteenth, which was therefore called *Fathr-Miriam*, the cessation of the fast of the virgin.

ABA (or rather ABAU) HANIFAH or HANFA, surnamed Al-Nooma, was the son of Thabet, and born at Coufah in the 80th year of the Hegira. This is the most celebrated doctor of the orthodox Mussulmans, and his sect is held in greatest esteem among the four which they indifferently follow. Notwithstanding this, he was not very well esteemed during his life; insomuch that the caliph Almansor caused him to be imprisoned at Bagdad, for having refused to subscribe to the opinion of absolute predestination, which the Mussulmans call Cadha. But afterwards Abou Joseph, who was the sovereign judge or chancellor of the empire under the caliph Hadi, brought his doctrine into such credit, that it became a prevailing opinion, That to be a good Mussulman was to be a Hanifite. He died in the 150th year of the Hegira, in the prison of Bagdad: and it was not till 335 years after his death, that Melick Schah, a sultan of the Selgiucidan race, erected to his memory a magnificent monument in the same city, and a college for his followers, in the 485th year of the Hegira, and Anno Christi 1092. The most

eminent successors of this doctor were Ahmed Benali, Al Giassas, and Al Razi who was the master of Nasari; and there is a mosque particularly appropriated to them in the temple of Mecca.

ABA, *Abas*, *Abos*, or *Abus*, in *Ancient Geography*, the name of a mountain of Greater Armenia, situated between the mountains Niphatos and Nibonis. According to Strabo, the Euphrates and Araxes rose from this mountain; the former running eastward, and the latter westward.

ABA. See ABÆ.

ABA, ALBON, or OVON, a king of Hungary. He married the sister of Stephen I. and was elected king on the deposition of Peter in 1041. The emperor Henry III. preparing to reinstate Peter on the throne, Aba made an incursion into his dominions, and returned loaded with booty; but was next year obliged to make restitution, by paying a large sum, in order to prevent a threatened invasion from the emperor. He indulged in great familiarity with the lower class of the people, on account of which, and his severity to their order, he became universally odious to the nobility. The fugitive nobles, aided by the emperor, excited a revolt against him. After a bloody battle, Aba was put to flight; and was murdered by his own soldiers in 1044, having reigned three years.

ABAA, a river in Thessaly, supposed by some to be the Peneus of the ancients.

ABACÆNA, in *Ancient Geography*, a town of Media, and another of Caria in the Hither Asia.

ABACÆNUM, in *Ancient Geography*, a town of Sicily, whose ruins are supposed to be those lying near Trippi, a citadel on a high and steep mountain not far from Messina. The inhabitants were called *Abacænini*.

ABACH, a market town of Germany, in Lower Bavaria, seated on the Danube, 12 miles S. W. of Ratisbon. It is remarkable for Roman antiquities, and for springs of mineral waters which are said to be good for various distempers. E. Long. 11. 56. N. Lat. 48. 53.

ABACINARE, or ABBACINARE, in writers of the middle age, a cruel species of punishment, consisting in the blinding of the criminal, by holding a red-hot bason or bowl of metal before his eyes.

ABACK (a sea term), the situation of the sails when the surfaces are flatted against the masts by the force of the wind. The sails are said to be *taken aback* when they are brought into this situation, either by a sudden change of the wind, or by an alteration in the ship's course. They are *laid aback*, to effect an immediate retreat, without turning to the right or left; or, in the sea phrase, to give the ship *stern-way*, in order to avoid some danger discovered before her in a narrow channel, or when she has advanced beyond her station in the line of battle, or otherwise. The sails are placed in this position by slackening their lee braces, and hauling in the weather ones; so that the whole effort of the wind is exerted on the fore part of their surface, which readily pushes the ship astern, unless she is restrained by some counteracting force. It is also usual to spread some sail aback near the stern, as the mizen-top-sail, when a ship rides with a single anchor in a road, in order to prevent her from approaching it so as to entangle the flukes of it with her slackened cable, and thereby loosen it from the ground.

Aba
||
Aback.

Abacot
||
Abacus.

ABACOT, the name of an ancient cap of state worn by the kings of England, the upper part whereof was in the form of a double crown.

ABACTORS, or ABACTORES, a name given to those who drive away, or rather steal, cattle by herds, or great numbers at once; and are therefore very properly distinguished from *fures* or thieves.

ABACUS, among the ancients, was a kind of cupboard or buffet. Livy, describing the luxury into which the Romans degenerated after the conquest of Asia, says they had their *abaci*, beds, &c. plated over with gold.

ABACUS, among the ancient mathematicians, signified a table covered with dust, on which they drew their diagrams; the word in this sense being derived from the Phœnician *abak*, dust.

ABACUS, or ABACISCUS, in *Architecture*, signifies the superior part or member of the capital of a column, and serves as a kind of crowning to both. Vitruvius tells us the abacus was originally intended to represent a square tile laid over an urn, or rather over a basket. See *ARCHITECTURE*, N^o 15.—The form of the abacus is not the same in all orders: In the Tuscan, Doric, and Ionic, it is generally square; but in the Corinthian and Composite, its four sides are arched inwards, and embellished in the middle with some ornament, as a rose or other flower. Scamozzi uses *abacus* for a concave moulding on the capital of the Tuscan pedestal; and Palladio calls the plinth above the echinus, or boudin, in the Tuscan and Doric orders, by the same name.

ABACUS is also the name of an ancient instrument for facilitating operations in arithmetic. It is variously contrived. That chiefly used in Enrope is made by drawing any number of parallel lines at the distance of two diameters of one of the counters used in the calculation. A counter placed on the lowest line, signifies 1: on the 2d, 10; on the 3d, 100; on the 4th, 1000, &c. In the intermediate spaces, the same counters are estimated at one half of the value of the line immediately superior, viz. between the 1st and 2d, 5; between the 2d and 3d, 50, &c. See Plate I. fig. 1. where the same number, 1802 for example, is represented under both divisions by different dispositions of the counters. A farther illustration of this mode of notation is given in fig. 2.

National debt, according to Mr Ad-	
dington, 1st Feb. 1802,	L.400,709,832
According to Mr Tierney,	- 457,154,081
According to Mr Morgan,	- 558,418,628
New sinking fund,	- 3,275,143
Old sinking fund,	- 2,534,187

ABACUS is also used by modern writers for a table of numbers ready cast up, to expedite the operations of arithmetic. In this sense we have *Abaci* of addition, of multiplication, of division. This instrument for computation is, under some variations, in use with most nations, as the Greeks, Romans, Germans, French, Chinese, &c.

Grecian ABACUS, was an oblong frame, over which were stretched several brass wires, strung with little ivory balls, like the beads of a necklace; by the various arrangements of which all kinds of computations were easily made.

Roman ABACUS was a little varied from the Gre-

cian, having pins sliding in grooves, instead of strings or wires and beads.

Chinese ABACUS, or SHWANPAN, like the Grecian, consists of several series of beads strung on brass wires, stretched from the top to the bottom of the instrument, and divided in the middle by a cross piece from side to side. In the upper space every string has two beads, which are each counted for 5; and in the lower space every string has five beads, of different values, the first being counted as 1, the second as 10, the third as 100, and so on, as with us.

ABACUS Pythagoricus, the common multiplication table, so called from its being invented by Pythagoras.

ABACUS Logisticus, is a rectangled triangle, whose sides, forming the right angle, contain the numbers from 1 to 60; and its area, the facta of each two of the numbers perpendicularly opposite. This is also called a *canon of sexagesimals*.

ABACUS et Palmulae, in the *Ancient Music*, denote the machinery, whereby the strings of polyplectra, or instruments of many strings, were struck with a plectrum made of quills.

ABACUS Harmonicus, is used by Kircher for the structure and disposition of the keys of a musical instrument, whether to be touched with the hands or the feet.

ABACUS Major, in metallurgic operations, the name of a trough used in the mines, wherein the ore is washed.

ABADDON, is the name which St John in the Revelation gives to the king of the locusts, the angel of the bottomless pit. The inspired writer says, this word is Hebrew, and in Greek signifies *Ἀπολλων*, i. e. a *destroyer*. That angel-king is thought to be Satan or the devil: but Mr le Clerc thinks with Dr Hammond, that by the locusts which came out of the abyss, may be understood the zealots and robbers, who miserably afflicted the land of Judea, and laid it in a manner waste, before Jerusalem was taken by the Romans; and that Abaddon, the king of the locusts, may be John of Gischala, who having treacherously left that town a little before it was surrendered to Titus, came to Jerusalem, where he soon headed part of the zealots, who acknowledged him as their king, whilst the rest would not submit to him. This subdivision of the zealot party brought a thousand calamities on the Jews.

ABADIR, a title which the Carthaginians gave to gods of the first order. In the Roman mythology, it is the name of a stone which Saturn swallowed, by the contrivance of his wife Ops, believing it to be his newborn son Jupiter: hence it became the object of religious worship.

ABÆ, or ABA, in *Ancient Geography*, a town of Phocis in Greece, near Helicon; famous for an oracle of Apollo older than that at Delphi, and for a rich temple which was plundered and burnt by the Persians.

ABAST, a sea term, signifying the hinder part of a ship, or all those parts both within and without which lie towards the stern, in opposition to *AFORE*; which see.—*Abast*, is also used as a preposition, and signifies *further aft*, or *nearer the stern*: as, the barricade stands *abast* the main-mast, i. e. behind it, or nearer the stern.

ABAISSED, *abaisse*, in *Heraldry*, an epithet applied to the wings of eagles, &c. when the tip looks downwards

Abacus
||
Abaisied.

Abaissed downwards to the point of the shield, or when the wings are shut; the natural way of bearing them being extended.

Abantias.

ABAKA KHAN, the eighth emperor of the Moguls, a wise and good prince, ascended the throne in 1264. He reigned 17 years, and is by some authors said to have been a Christian. It may be admitted, indeed, that he joined with the Christians in keeping the feast of Easter, in the city Hamadan, a short time before his death. But this is no proof of his Christianity; it being common, in times of brotherly love, for Christians and Mahometans to join in keeping the same feasts, when each would compliment the other with doing honour to his solemnity.

ABAKANSKOL, a town of Siberia, which was founded by Peter the Great in 1707. It is provided with a garrison, to protect the hunters who are employed in catching martens and foxes on account of their furs, which are here an important article of commerce. It is situated in E. Long. 94. 5. N. Lat. 53. 30.

ABALAK, a small town of Siberia, two miles from Tobolsk, in E. Long. 64. 10. N. Lat. 57. 1. Abalak is famous as the resort of many pilgrims who visit an image of the virgin Mary, which is annually carried in procession to Tobolsk.

ABALIENATION, in *Law*, the act of transferring one man's property to another.

ABALLABA, the ancient name of **APPLEBY**, a town in Westmoreland, remarkable only for its antiquity, having been a Roman station. W. Long. 1. 4. N. Lat. 55. 38.

ABALUS, in *Ancient Geography*, supposed by the ancients to be an island in the German ocean, called by *Timæus Basilis*, and by *Xenophon Lampsacenus Baltia*; now the peninsula of Scandinavia. Here, according to *Pliny*, some imagined that amber dropped from the trees.

ABANA, or **AMANA**, in *Ancient Geography*, a river of Phœnicia, which, rising from Mount Hermon, washed the south and west sides of Damascus, and falls into the Phœnician sea to the north of Tripolis, called *Chrysorrheas*, by the Greeks.

ABANGA. See **ADY**.

ABANO, a town of the Paduano, in the republic of Venice, famous among the ancients for its hot baths.

ABANTES, a people who came originally from Thrace, and settled in Phocœa, a country of Greece, where they built a town which they called *Aba*, after the name of Abas their leader; and if we may credit some ancient authors, the Abantes went afterwards into the island Eubœa, now called *Negropont*: others say the Abantes of Eubœa came from Athens. The Abantes were a very warlike people, closing with their enemies, and fighting hand to hand.

ABANTIAS, or **ABANTIS**, in *Ancient Geography*, a name of the island Eubœa in the Egean sea, extending along the coast of Greece, from the promontory Sunium in Attica to Thessaly, and separated from Boœtia by a narrow strait called *Euripus*. From its length the island was formerly called *Macris*; afterwards *Abantias* or *Abantis*, from the Abantes, a people originally of Thrace, called by *Homer* *ἐπισθεν Κορωνίης*, from wearing their hair long behind, having in a battle experienced the inconvenience of wearing long hair be-

fore. From cutting their hair before, they were called *Curetes*.

Abantias

Abaris.

ABAPTISTON, in *Surgery*, the perforating part of the instrument called a **TREPAN**. This instrument, which is mentioned by *Galen*, *Fabricius ab Aquapendente*, and others, was a conical saw with a circular edge. Modern practitioners, however, prefer the cylindrical form; and various contrivances have been recommended to obviate the danger that may arise from want of dexterity, or from rashness, in performing the operation of trepanning. A new instrument has been lately invented and delineated for this purpose, by *Mr Rodman*, surgeon in Paisley. This instrument is so contrived, that it can be fitted to cut any thickness of bone without danger of injuring the brain; and as no pivot or centre pin is necessary, the dreadful accidents which have sometimes happened by not removing it, when the instrument in common use is employed, are completely avoided. (*Philosoph. Mag. April 1802.*)

ABARA, a town in the Greater Armenia, under the dominion of the Turks; it is often the residence of the archbishop of Naksivan. E. Long. 46. 25. N. Lat. 39. 45.

ABARANER, a town of Asia, in the Greater Armenia, belonging to the Turks: it is seated on the river *Alingena*. E. Long. 46. 30. N. Lat. 39. 50.

ABARCA, an ancient kind of shoe used in Spain for passing the mountains with. It was made of raw hides, and bound with cords, which secured the feet of travellers against the snow.

ABARIM, high mountains of steep ascent, separating the country of the Ammonites and Moabites from the land of Canaan, where Moses died. According to *Josephus*, they stood opposite to the territory of Jericho, and were the last station but one of the Israelites coming from Egypt. *Nebo* and *Pisgah* were parts of these mountains.

ABARIS, the Hyperborean, a celebrated sage of antiquity, whose history and travels have been the subject of much learned discussion. Such a number of fabulous stories*, were told of him, that *Herodotus* himself seems to scruple to relate them. He tells us only†, that this barbarian was said to have travelled with an arrow, and to have taken no sustenance: but this does not acquaint us with the marvellous properties which were attributed to that arrow; nor that it had been given him by the Hyperborean *Apollo*. With regard to the occasion of his leaving his native country, *Harpocration*‡ tells us, that the whole earth being infested with a deadly plague, *Apollo*, upon being consulted, gave no other answer, than that the Athenians should offer up prayers in behalf of all other nations; upon which, several countries deputed ambassadors to Athens, among whom was *Abaris* the Hyperborean. In this journey, he renewed the alliance between his countrymen and the inhabitants of the island of *Delos*. It appears that he also went to *Lacedæmon*; since according to some writers||, he there

* *Jamblich, Vita Pythag.*
† *Lib. iv. cap. 36.*

‡ Under the word *Abaris*

|| *Pausanias, lib. iii. p. 94.*

§ *Porphyrus, in Vita Pythagor.*
* Under the word *Abaris*

Himerius

Abaris,
Abarticulation.

* Account
of the
Druids, in
his *Posthu-
morum
Works*,
vol. i.
p. 161.
† Diod Sic.
lib. ii. iii.

‡ Jamblichus
*Vita Py-
thag.*
p. 128.

Himerius the sophist applauds him for speaking pure Greek; which attainment will be no matter of wonder to such as consider the ancient intercourse there was between the Greeks and Hyperboreans.—If the Hebrides, or Western islands of Scotland, (says Mr Toland *), were the Hyperboreans of Diodorus †, then the celebrated Abaris was of that country; and likewise a druid, having been the priest of Apollo. Suidas, who knew not the distinction of the insular Hyperboreans, makes him a Scythian; as do some others, misled by the same vulgar error; though Diodorus has truly fixed his country in an island, and not on the continent. Indeed the fictions and mistakes concerning our Abaris are infinite: however, it is agreed by all that he travelled quite over Greece, and from thence into Italy, where he conversed familiarly with Pythagoras, who favoured him beyond all his disciples, by instructing him in his doctrines (especially his thoughts of nature) in a plainer and more compendious method than he did any other. This distinction could not but be very advantageous to Abaris. The Hyperborean, in return, presented the Samian, as though he equalled Apollo himself in wisdom, with the sacred arrow, on which the Greeks have fabulously related ‡ that he sat astride, and flew upon it, through the air, over rivers and lakes, forests and mountains; in like manner as our vulgar still believe, particularly those of the Hebrides, that wizards and witches fly whithersoever they please on their broomsticks. The orator Himerius above mentioned, though one of those who, from the equivocal sense of the word *Hyperborean*, seem to have mistaken Abaris for a Scythian, yet describes his person accurately, and gives him a very noble character. “They relate (says he) that Abaris the sage was by nation a Hyperborean, appeared a Grecian in speech, and resembled a Scythian in his habit and appearance. He came to Athens, holding a bow in his hand, having a quiver hanging on his shoulders, his body wrapt up in a plaid, girt about the loins with a gilded belt, and wearing trowsers reaching from his waist downward.” By this it is evident (continues Mr Toland) that he was not habited like the Scythians, who were always covered with skins; but appeared in the native garb of an aboriginal Scot. As to what relates to his abilities, Himerius informs us, that “he was affable and pleasant in conversation, in dispatching great affairs secret and industrious, quick-sighted in present exigencies, in preventing future dangers circumspect, a searcher after wisdom, desirous of friendship, trusting little to fortune, and having every thing trusted to him for his prudence.” Neither the Academy nor the Lycæum could have furnished a man with fitter qualities to travel so far abroad, and to such wise nations, about affairs no less arduous than important. And if we further attentively consider his moderation in eating, drinking, and the use of all those things which our natural appetites incessantly crave; joining the candour and simplicity of his manners with the solidity and wisdom of his answers; all which we find sufficiently attested; it must be owned that the world at that time had few to compare with Abaris.

ABARTICULATION, in *Anatomy*, a species of articulation, admitting of a manifest motion; called al-

so *Diarthrosis*, and *Dearticulatio*, to distinguish it from that sort of articulation which admits of a very obscure motion, and is called *Synarthrosis*. Abarticulation
||
Abassa.

ABAS, a weight used in Persia for weighing pearls. It is one-eighth less than the European carat.

ABAS, in heathen mythology, was the son of Hypothon and Meganira, who entertained Ceres, and offered a sacrifice to that goddess; but Abas ridiculing the ceremony, and giving her opprobrious language, she sprinkled him with a certain mixture she held in her cup, on which he became a newt or water lizard.

ABAS, *Schah*, the Great, was third son of Codabendi, 7th king of Persia of the race of the Sophis. Succeeding to his father in 1585, at the age of 18, he found the affairs of Persia at a low ebb, occasioned by the conquests of the Turks and Tartars. He regained several of the provinces they had seized; but death put a stop to his victories in 1629, after a reign of 44 years. He was the greatest prince who had reigned in Persia for many ages; and it was he who made Ispahan the metropolis of Persia. His memory is held in the highest veneration among the Persians.

ABAS, *Schah*, his grandson, 9th king of Persia of the race of the Sophis, succeeded his father Sesi at 13 years of age. He was but 18 when he made himself master of the city of Candahar, which had surrendered in his father's reign to the great Mogul, and all the province about it; and he preserved it afterwards against this Indian emperor, though he besieged it more than once with an army of 300,000 men. He was a very merciful prince, and openly protected the Christians. He had formed a design of extending the limits of his kingdom toward the north, and had for that effect levied a powerful army; but death put a stop to all his great designs, at 37 years of age, A.D. 1666.

ABASCIA, or ABCASSIA, the northern district of the western division of Georgia in Asia, situated on the coast of the Black sea, and tributary to the Turks. The inhabitants are poor, thievish, and treacherous, so that there is no trading with them without the utmost caution. They trade in furs, buck and tyger skins, linen yarn, boxwood, and bees wax: but their principal traffic consists in the sale of their own children to the Turks, and to one another. They are destitute of many necessities of life, and have nothing among them that can be called a town; though we find Anacopia, Dandar, and Czekorni, mentioned in the maps. They have the name of Christians; but have nothing left but the name, any more than the Mingrelians their northern neighbours. The men are robust and active, and the women are fair and beautiful; on which account the Turks have a great value for the female slaves which they purchase from among them. Their customs are much the same as those of the MINGRELIANS; which see. E. Long. from 39° to 43°. N. Lat. from 43° to 45°.

ABASCUS, a river of Asiatic Sarmatia, which, rising from Mount Caucasus, falls into the Euxine, between Pityus to the east, and Nosis to the west.

ABASITIS, in *Ancient Geography*, a tract of Asiatic Mysia, in which was situated the city of Ancyra.

ABASSA, THE GREATER and THE SMALLER, two districts in the vicinity of the Caucasian mountains. The latter, according to Pallas, is inhabited by six tribes who were formerly Christians, but the nobles now profess

Abassa
||
Abatis.

fess the Mahometan religion. In manners, dress, mode of life, and, in some degree, in language, they resemble the Circassians. They practise agriculture, but chiefly depend on pasturage for their subsistence. They are celebrated for a fine breed of large horses. They are frequently harassed and plundered by the Circassian princes.

ABASSI, or ABASSIS, a silver coin current in Persia, equivalent in value to a French livre, or tenpence halfpenny sterling. It took its name from Schah Abbas II. king of Persia, under whom it was struck.

ABASSUS, in *Ancient Geography*, a town of the Greater Phrygia, on the confines of the Tolistobagii, a people of Galatia in Asia.

ABATAMENTUM, in *Law*, is an entry to lands by interposition, i. e. when a person dies seized, and another who has no right enters before the heir.

To ABATE, (from the French *abattre*, to pull down, overthrow, demolish, batter down, or destroy), a term used by the writers of the English common law both in an active and neutral sense; as, To *abate* a castle, is to beat it down. To *abate* a writ, is, by some exception, to defeat or overthrow it. A stranger *abateth*; that is, entereth upon a house or land void by the death of him that last possessed it, before the heir takes possession, and so keepeth him out: wherefore, as he that putteth out him in possession is said to disseize, so he that steppeth in between the former possessor and his heir is said to *abate*. In the neuter signification thus; The writ of the demandant shall *abate*; that is, shall be disabled, frustrated, or overthrown. The appeal *abateth* by covin; that is, the accusation is defeated by deceit.

ABATE, in the manege, implies the performing any downward motion properly. Thus a horse is said to *abate* or take down his curvets, when he puts both his hind legs to the ground at once, and observes the same exactness in all the times.

ABATELEMENT, in commerce, a term used for a prohibition of trade to all French merchants in the ports of the Levant who will not stand to their bargains, or refuse to pay their debts. It is a sentence of the French consul, which must be taken off before they can sue any person for the payment of their debts.

ABATEMENT, in *Heraldry*, an accidental figure supposed to have been added to coats of arms, in order to denote some dishonourable demeanour or stain, whereby the dignity of coat armour was rendered of less esteem. See HERALDRY.

ABATEMENT, in *Law*. See To ABATE.

ABATEMENT, in the customs, an allowance made upon the duty of goods, when the quantum damaged is determined by the judgment of two merchants upon oath, and ascertained by a certificate from the surveyor and land waiter.

ABATIS, an ancient term for an officer of the stables.

ABATIS, or ABATTIS, in military affairs, a kind of retrenchment made of felled trees. In sudden emergencies, the trees are merely laid lengthwise beside each other, with the branches pointed outwards to prevent the approach of the enemy, while the trunks serve as a breastwork to the defendants. When the abatis is employed for the defence of a pass or entrance, the boughs of the trees are stripped of their leaves and

pointed, the trunks are planted in the ground, and the branches interwoven with each other.

ABATON, a building at Rhodes, erected as a fence to the trophy of Artemisia, queen of Halicarnassus, Coos, &c. raised in memory of her victory over the Rhodians; or rather to conceal the disgrace of the Rhodians from the eyes of the world: for to efface or destroy the trophy was with them a point of religion.

ABATOR, in *Law*, a term applied to a person who enters to a house or lands void by the death of the last possessor, before the true heir.

ABATOS, in *Ancient Geography*, an island in the lake Moeris, formerly famous for its papyrus. It was the burial place of Osiris.

ABAUZIT, FIRMIN, a learned Frenchman, was born at Usez, in Languedoc, in November 1679. His father died when he was but two years of age. In consequence of the revocation of the edict of Nantz, in the time of Louis XIV. to avoid the rigours of persecution to which the Protestants of France were exposed, young Abauzit's mother, who was a Protestant, not without difficulty, escaped with her son to Geneva, where he remained secure from danger, and enjoyed the benefit of education. From his 10th to his 19th year, his time was wholly devoted to literature; and having made great progress in languages, he studied mathematics, physics and theology. In the year 1698, he travelled into Holland, where he became acquainted with the learned Bayle, with Basnage and Jurieu. Thence he passed over to England, and was introduced to Sir Isaac Newton, who entertained a very high opinion of his merit. For this philosopher afterwards sent him his *Commercium Epistolicum*, accompanied with a very honourable testimony. "You are well worthy," says Newton, to judge between Leibnitz and me." The reputation of Abauzit reached the ears of King William, who encouraged him by a very handsome offer to settle in England; which he declined, and returned to Geneva. In 1715 he entered into the society formed for the purpose of translating the New Testament into the French language, and contributed valuable assistance to this work. The chair of philosophy in the university was offered to him by that body in 1723, which he refused on account of his health and diffidence of his talents. But in 1727 he accepted of the office of librarian to the city, the duties of which were neither burdensome, nor subjected him to any particular restraint.

Abauzit, who was deeply conversant in physical and mathematical knowledge, was one of the first who embraced the grand truths which the sublime discoveries of Newton exhibited to the world. He defended the doctrines of that philosopher against Father Castel; and discovered an error in the *Principia*, which was corrected by Newton in the second edition of his work. He was a perfect master of many languages; he understood history so exactly, that he remembered the names of the principal characters and the dates of the events; his knowledge of physics was deep and extensive, and he was well acquainted with medals and ancient manuscripts. The different sciences which he had studied, were so well digested and arranged in his retentive mind, that he could at once bring together all that he ever knew on any subject. A remarkable instance of this occurred in a conversation with

Rousseau.

Abatis
||
Abauzit.

Abauzit
||
Abba.

Rousseau on the music of the ancients, while the latter was employed in compiling his Dictionary of Music. He had been at great pains in giving an accurate account of ancient music. But how much was he surprised to find that Abauzit could give him a full and clear history of all that he had with much labour collected; and the more so, when he was informed that 30 years had elapsed since his inquiries led him to consider that subject. It was probably in consequence of this incident that Rousseau addressed to Abauzit one of the finest panegyrics which he ever wrote.

A very fine compliment is said to have been paid to Abauzit by Voltaire. A stranger having addressed the poet in a flattering manner, by saying he had come to Geneva to see a great man, Voltaire asked him, whether he had seen Abauzit?

This excellent man having enjoyed that *otium cum dignitate*, so much talked of, and so eagerly sought after, but rarely obtained, having thus lived universally respected to the great age of 87 years, died in the year 1787, lamented by the republic, and regretted by the learned.

Abauzit was a sincere Christian; his piety was pure and unaffected; his benevolence was extensive. Liberal in his opinions, he was indulgent and forbearing to those whose sentiments and opinions were different from his own. Simple and easy in his manners, every thing about him, his house, his person, and his way of life, discovered a strong aversion to show and luxury. He carefully avoided the officious observances of ceremony, and anxiously withdrew from the fulsome praise of flattery. His conversation, free from pedantry and ostentation, instructive and entertaining, was always heard with eagerness, and listened to with attention.

The writings which Abauzit left behind him are chiefly on religious subjects. He wrote an "Essay on the Apocalypse," in which he endeavoured to show, that the predictions in that book were to be applied to the destruction of Jerusalem. This work was translated into English; to which a refutation was added, which satisfied Abauzit so much that he was mistaken in his views, that he ordered an edition then ready for publication in Holland to be stopped. His other works are, "Reflections on the Eucharist; On Idolatry; On the Mysteries of Religion; Paraphrases and Explanations of sundry parts of Scripture; Several Critical and Antiquarian Pieces; and various Letters."

ABAVO, in *Botany*, a synonyme of the ADANSONIA.

ABB, a term among clothiers applied to the yarn of a weaver's warp. They say also *Abb-wool* in the same sense.

ABBA, in *Ancient Geography*, a town of Africa Propria, near Carthage.

ABBA, in the Syriac and Chaldee languages, literally signifies a *father*; and figuratively, a superior, reputed as a father in respect of age, dignity, or affection. It is more particularly used in the Syriac, Coptic, and Ethiopic churches, as a title given to the bishops. The bishops themselves bestow the title of *Abba* more eminently on the bishop of Alexandria; which occasioned the people to give him the title of *Baba*, or *Papa*, that is *Grandfather*; a title which he bore before the bishop of Rome. It is a Jewish title of honour given to certain rabbins called *Tanaites*; and it is also particularly used, by some writers of the middle

age, for the superior of a monastery, usually called AB-BOT.

ABBADIE, JAMES, an eminent Protestant divine, born at Nay in Bern in 1654; first educated there under the famous John la Placette, and afterwards at the university of Sedan. From whence he went into Holland and Germany, and was minister in the French church of Berlin. He left that place in 1690; came into England; was some time minister in the French church in the Savoy, London; and was made dean of Killalo in Ireland. He was strongly attached to the cause of King William, as appears in his elaborate defence of the Revolution, and his history of the assassination-plot. He had great natural abilities, which he improved by true and useful learning. He was a most zealous defender of the primitive doctrine of the Protestants, as appears by his writings; and that strong nervous eloquence for which he was so remarkable, enabled him to enforce the doctrines of his profession from the pulpit with great spirit and energy. He possessed uncommon powers of memory. It is said that he composed his works without committing any part to writing, till they were wanted for the press. He died in London in 1727, after his return from a tour in Holland. He published several works in French that were much esteemed; the principal of which are, *A Treatise on the Truth of the Christian religion; The Art of Knowing one's Self; A Defence of the British Nation; the Deity of Jesus Christ essential to the Christian Religion; The History of the last Conspiracy in England*, written by order of King William III.; and *The Triumph of Providence and Religion, or the opening the Seven Seals by the Son of God*.

ABBAS, son of Abdalmotalleb, and Mahomet's uncle, opposed his nephew with all his power, regarding him as an impostor and traitor to his country; but in the second year of the Hegira, being overcome and made a prisoner at the battle of Beder in 623, a great ransom being demanded for him, he represented to Mahomet, that his paying it would reduce him to beggary, which would bring dishonour on the family. Mahomet, who knew that he had concealed large sums of money, said to him, "Where are the purses of gold that you gave your mother to keep when you left Mecca?" Abbas, who thought this transaction secret, was much surprised, and conceiving that his nephew was really a prophet, embraced his religion. He became one of his principal captains; and saved his life when in imminent danger at the battle of Honain, against the Thakefites, soon after the reduction of Mecca. But besides being a great commander, Abbas was one of the first doctors of Islamism, the whole of whose science consisted in being able to repeat and explain the Koran, and to preserve in their memory certain apocryphal histories. He is said to have read lectures on every chapter of the Koran, as his nephew pretended to receive them from heaven. He died in 652, and his memory is held in the highest veneration among the Mussulmans to this day.

Abul-ABBAS, surnamed *Saffah*, one of his grandsons, was proclaimed caliph a century after his death; and in him began the dynasty of the

ABBASSIDES, who possessed the caliphate for 524 years. There were 37 caliphs of this race who succeeded one another without interruption.

ABBE,

Abba
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Abbassides.

Abbé
||
Abbey.

Abbey.

ABBE', in a monastic sense, the same with ABBOT. ABBE', in a modern sense, the denomination of a class of persons which has been popular in France. They were not in orders; but having received the ceremony of tonsure, were entitled to enjoy certain privileges in the church. The dress of abbés was that of academics or professed scholars. In colleges they were the instructors of youth, and were employed as tutors in private families. Many of them have risen to a distinguished rank in the state, while others have been no less eminent in science and literature.

ABBESS, the superior of an abbey or convent of nuns. The abbess has the same rights and authority over her nuns that the abbots regular have over their monks. The sex indeed does not allow her to perform the spiritual functions annexed to the priesthood, with which the abbot is usually invested; but there are instances of some abbesses who have a right, or rather a privilege, to commission a priest to act for them. They have even a kind of episcopal jurisdiction, as well as some abbots who are exempted from the visitation of their diocesans.

Martene, in his treatise on the rights of the church, observes, that some abbesses have formerly confessed their nuns. But he adds, that their excessive curiosity carried them such lengths, that there arose a necessity of checking it. However, St Basil, in his Rule, allows the abbess to be present with the priest at the confession of her nuns.

ABBEVILLE, a considerable city of France, in the department of the Somme. The river Somme divides it into two parts. It has a collegiate church and twelve parish churches, the most considerable of which are St George's and St Giles's; and it is the seat of two tribunals. It is a fortified town; the walls are flanked with bastions, and surrounded by large ditches. Never having been taken, from this circumstance it is sometimes called the *Maiden Town*; and hence too its motto, *Semper fidelis*. The number of the inhabitants in 1800 amounted to 18,052. The situation in the midst of a fertile valley is pleasant and healthy. It is famous for its woollen manufactory, established in 1665 under the auspices of Colbert. The stuffs manufactured here are said to equal in fabric and quality the finest in Europe. There is also a manufactory of fire arms, and a considerable trade in grain, lint, and hemp. It is about 11 miles east of the British channel, and ships may come from thence by the river Somme to the middle of the town. E. Long. 1. 50. N. Lat. 50. 7.

ABBEY, a monastery, or religious house, governed by a superior under the title of *abbot* or *abbess*.

Abbeys differ only from *priories*, that the former are under the direction of an abbot, and the others of a prior; for abbot and prior (we mean a prior conventual) are much the same thing, differing in little but the name.

Fauchet observes, that, in the early days of the French monarchy, dukes and counts were called *abbots*, and duchies and counties *abbeys*. Even some of their kings are mentioned in history under the title of *abbots*. Philip I. Louis VI. and afterwards the duke of Orleans, are called *abbots of the monastery of St Aignan*. The dukes of Aquitaine were called *abbots of the monastery of St Hilary at Poitiers*; and the earls of Anjou, of *St Aubin*, &c.

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†

Monasteries were at first established as religious houses, to which persons retired from the bustle of the world to spend their time in solitude and devotion. But they soon degenerated from their original institution, and obtained large privileges, exemptions, and riches. They prevailed greatly in Britain before the Reformation, particularly in England; and as they increased in riches, so the state became poor: for the lands which these regulars possessed were *in mortua manu*, i. e. could never revert to the lords who gave them. This inconvenience gave rise to the statutes against gifts in *mortmain*, which prohibited donations to these religious houses; and Lord Coke tells us, that several lords, at their creation, had a clause in their grant, that the donor might give or sell his land to whom he would, (*exceptis viris religiosis et Judæis*) excepting monks and Jews.

These places were wholly abolished in England at the time of the Reformation; Henry VIII. having first appointed visitors to inquire into the lives of the monks and nuns, which were found in some places to be extremely irregular, the abbots, perceiving their dissolution unavoidable, were induced to resign their houses to the king, who by that means became invested with the abbey lands: these were afterwards granted to different persons, whose descendants enjoy them at this day: they were then valued at 2,853,000l. per annum, an immense sum in those days.

Though the suppression of religious houses, even considered in a political light only, was a great national benefit, it must be owned, that at the time they flourished, they were not entirely useless. Abbeys or monasteries were then the repositories, as well as the seminaries, of learning; many valuable books and national records, as well as private history, having been preserved in their libraries, the only places in which they could have been safely lodged in those turbulent times. Many of those, which had escaped the ravages of the Danes, were destroyed with more than Gothic barbarity at the dissolution of the abbeys. These ravages are pathetically lamented by John Bale, in his declaration upon Leland's Journal 1549. "Covetousness," says he, "was at that time so busy about private commodity, that public wealth, in that most necessary and of respect, was not anywhere regarded. A number of them which purchased these superstitious mansions, reserved of the library books, some to serve their jakes, some to scour the candlesticks, and some to rub their boots; some they sold to the grocer and soap-seller; and some they sent over sea to the bookbinders, not in small numbers, but in whole ships full; yea, the universities of this realm are not clear of so detestable a fact. I know a merchant that bought the contents of two noble libraries for 40s. price; a shame it is to be spoken! This stuff hath he occupied instead of gray paper, by the space of more than these ten years, and yet he hath store enough for as many years to come. I shall judge this to be true, and utter it with heaviness, that neither the Britons under the Romans and Saxons, nor yet the English people under the Danes and Normans, had ever such damage of their learned monuments as we have seen in our time."

In these days every abbey had at least one person whose office it was to instruct youth; and the historians of this country are chiefly beholden to the monks

B

for

Abbey
||
Abbot.

for the knowledge they have of former national events. In these houses also the arts of painting, architecture, and printing, were cultivated. They were hospitals for the sick and poor, and afforded entertainment to travellers at a time when there were no inns. In them the nobility and gentry who were heirs to their founders could provide for a certain number of ancient and faithful servants, by procuring them corodies, or stated allowances of meat, drink, and clothes. They were likewise an asylum for aged and indigent persons of good family. The neighbouring places were also greatly benefited by the fairs procured for them, and by their exemption from forest laws; add to which, that the monastic estates were generally let at very easy rents, the fines given at renewals included.

ABBEYBOYLE, a town of Ireland, in the county of Roscommon, and province of Connaught. W. Long. 8. 32. N. Lat. 53. 54. It is remarkable for an old abbey.

ABBEYHOLM, a town in Cumberland, so called from an abbey built there by David king of Scots. It stands on an arm of the sea. W. Long. 3. 18. N. Lat. 54. 51.

ABBOT, or ABBAT, the superior of a monastery of monks erected into an abbey or priory.

The name *Abbot* is originally Hebrew, where it signifies father. The Jews call *father*, in their language, *Ab*; whence the Chaldeans and Syrians formed *Abba*; thence the Greeks *Αββας*, which the Latins retained; and hence our *Abbot*, the French *Abbé*, &c. St Mark and St Paul use the Syriac *Abba* in their Greek, by reason it was then commonly known in the synagogues and the primitive assemblies of the Christians; adding to it, by way of interpretation, the word *father*, *Αββας ο πατηρ*, "Abba, father;" q. d. Abba, that is to say, Father. But the name *Ab*, or *Abba*, which at first was a term of tenderness and affection in the Hebrew and Chaldee, became at length a title of dignity and honour: The Jewish doctors affected it; and one of their most ancient books, containing the sayings or apophthegms of divers of them, is entitled *Pirke Abboth* or *Avoth*; i. e. Chapters of the Fathers. It was in allusion to this affectation, that Jesus Christ forbade his disciples to call any man their father on earth; which word St Jerome turns against the superiors of the monasteries of his time, for assuming the titles of *Abbots*, or *Fathers*.

The name *Abbot*, then, appears as old as the institution of monks itself. The governors of the primitive monasteries assumed indifferently the titles *Abbots*, and *Archimandrites* *. They were really distinguished from the clergy; though frequently confounded with them, because a degree above laymen.

In those early days, the abbots were subject to the bishops and the ordinary pastors. Their monasteries being remote from cities, built in the farthest solitudes, they had no share in ecclesiastical affairs. They went on Sundays to the parish church with the rest of the people; or, if they were too remote, a priest was sent them to administer the sacraments; till at length they were allowed to have priests of their own body. The abbot or archimandrite himself was usually the priest: but his function extended no farther than to the spiritual assistance of his monastery; and he remained still in obedience to the bishop. There being among the

abbots several persons of learning, they made a vigorous opposition to the rising heresies of those times; which first occasioned the bishops to call them out of their deserts, and fix them about the suburbs of cities, and at length in the cities themselves; from which era their degeneracy is to be dated. Then the abbots threw off their former plainness and simplicity, assumed the rank of prelates, aspired at being independent of the bishops, and grasped at so much power, that severe laws were made against them at the council of Chalcedon. Many of them, however, carried the point of independency, obtained the appellation of *lord*, and were distinguished by other badges of the episcopate, particularly the mitre.

Hence arose new distinctions between the abbots. Those were termed *mitred* abbots, who were privileged to wear the mitre, and exercise episcopal authority within their respective precincts, being exempted from the jurisdiction of the bishop. Others were called *crossiered* abbots, from their bearing the crossier or pastoral staff. Others were styled *ecumenical* or universal abbots, in imitation of the patriarch of Constantinople: while others were termed *cardinal* abbots, from their superiority over all other abbots. In Britain, the mitred abbots were lords of parliament; and called *abbotsovereign*, and *abbots-general*, to distinguish them from the other abbots. And as there were lords-abbots, so there were also lords-priors, who had exempt jurisdiction, and were likewise lords of parliament. Some reckon 26 of these lords abbots and priors who sat in parliament. Sir Edward Coke says, that there were 27 parliamentary abbots and two priors. In the parliament 20 Rich. II. there were but 25 abbots and two priors: but in the summons to parliament anno 4 Ed. III. more are named.

In Roman Catholic countries, the principal distinctions observed between abbots are those of *regular* and *commendatory*. The former take the vow and wear the habit of their order; whereas the latter are seculars who have received tonsure, but are obliged by their bulls to take orders when of proper age.

Anciently the ceremony of creating an abbot consisted in clothing him with the habit called *cuculus*, or cowl; putting the pastoral staff into his hand, and the shoes called *pedales* on his feet: but at present, it is only a simple benediction, improperly called, by some, consecration.

ABBOT is also a title given to others beside the superiors of monasteries: thus bishops whose sees were formerly abbeys, are called abbots. Among the Genoese, the chief magistrate of the republic formerly bore the title of *abbot* of the people. It was likewise usual, about the time of Charlemagne, for several lords to assume the title of *count-abbots*, *abba-comites*; because the superintendency of certain abbeys was committed to them.

ABBOT, George, archbishop of Canterbury, was born October 29. 1562, at Guildford in Surrey. He was the son of Maurice Abbot a cloth-worker. He studied at Oxford, and in 1597 was chosen principal of University college. In 1599, he was installed dean of Winchester: the year following, he was chosen vice-chancellor of the university of Oxford, and a second time in 1603. In 1604, the translation of the Bible now in use was begun by the direction of King James: and

Abbot.

* See Monk
and Archi-
mandrite.

Abbot.

and Dr Abbot was the second of eight divines of Oxford, to whom the care of translating the whole New Testament (excepting the Epistles) was committed. The year following, he was a third time vice-chancellor. In 1608, he went to Scotland with George Hume earl of Dunbar, to assist in establishing an union between the churches of Scotland and England; and in this business he conducted himself with so much address and prudence, that it laid the foundation of all his future preferment. King James ever after paid great deference to his advice and counsel; and upon the death of Dr Overton bishop of Litchfield and Coventry, he named Dr Abbot for his successor, who was accordingly constituted bishop of those two united sees in December 1609. About a month afterwards he was translated to the see of London, and on the second of November following was raised to the archiepiscopal see.

It is not however improbable, that his extravagant adulation of his royal master, in which he went as far as any other court-chaplain could do, contributed not a little to his rapid preferment. In the preface to a pamphlet which he published, the following specimen of ridiculous flattery occurs: Speaking of the king, he says, "whose life hath been so immaculate and unspotted, &c. that even malice itself, which leaves nothing unsearched, could never find true blemish in it, nor east probable aspersion on it.—Zealous as a David; learned and wise, the *Solomon* of our age; religious as Josias; careful of spreading Christ's faith as Constantine the Great; just as Moses; undefiled in all his ways as a Jehosaphat and Hezekiah; full of clemency as another Theodosius."—If Mr Walpole had seen this passage, he certainly would not have said, that "honest Abbot could not flatter."

His great zeal for the Protestant religion made him a strenuous promoter of the match between the Elector Palatine and the Princess Elizabeth; which was accordingly concluded and solemnized the 14th of February 1612, the archbishop performing the ceremony on a stage erected in the royal chapel. In the following year happened the famous case of divorce between the lady Frances Howard, daughter of the earl of Suffolk, and Robert earl of Essex; which has been considered as one of the greatest blemishes of King James's reign. The part which the archbishop took in the business, added much to the reputation he had already acquired for incorruptible integrity. It was referred by the king to a court of delegates, whose opinion the king and court wished and expected to be favourable to the divorce. But the archbishop, unawed by royal authority, with inflexible firmness resisted it, and published his reasons for persisting in his opinion, to which the king, disappointed in his views, thought fit to reply: Sentence was given in the lady's favour. In 1618, the king published a declaration, which he ordered to be read in all churches, permitting sports and pastimes on the Lord's day: this gave great uneasiness to the archbishop; who, happening to be at Croydon on the day it was ordered to be read, had the courage to forbid it.

Being now in a declining state of health, the archbishop used in the summer to go to Hampshire for the sake of recreation; and being invited by Lord Zouch to hunt in his park at Bramzell, he met there with the

greatest misfortune that ever befel him; for he accidentally killed the game-keeper by an arrow from a cross-bow which he shot at one of the deer. This fatal accident threw him into a deep melancholy; and he ever afterwards kept a monthly fast on Tuesday, the day on which it happened; and he settled an annuity of 20l. on the widow*. Advantage was taken* of this misfortune, to lessen him in the king's favour; but his majesty said, "An angel might have miscarried in this sort." His enemies alleging that he had incurred an irregularity, and was thereby incapacitated for performing the offices of a primate; the king directed a commission to ten persons to inquire into this matter.

The result, however, was not satisfactory to his Grace's enemies; it being declared, that, as the murder was involuntary, he had not forfeited his archiepiscopal character. The archbishop after this seldom assisted at the council, being chiefly hindered by his infirmities; but in the king's last illness he was sent for, and constantly attended till his majesty expired on the 27th of March 1622. He performed the ceremony of the coronation of King Charles I. though very infirm and distressed with the gout. He was never greatly in this king's favour; and the duke of Buckingham being his declared enemy, watched an opportunity of making him feel the weight of his displeasure. This he at last accomplished, upon the archbishop's refusing to license a sermon, preached by Dr Sibthorpe to justify a loan which the king had demanded, and pregnant with principles which tended to overthrow the constitution. The archbishop was immediately after suspended from all his functions as primate; and they were exercised by certain bishops commissioned by the king, of whom Laud, the archbishop's enemy, and afterwards his successor, was one: while the only cause assigned for this procedure was, That the archbishop could not at that time personally attend those services which were otherwise proper for his cognizance and direction. He did not, however, remain long in this situation; for a parliament being absolutely necessary, his Grace was sent for, and restored to his authority and jurisdiction. But not proving friendly to certain rigorous measures adopted by the prevailing church party, headed by Laud, whose power and interest at court were now very considerable, his presence became unwelcome there; so that, upon the birth of the prince of Wales, afterwards Charles II. Laud had the honour to baptize him, as dean of the chapel. The archbishop being worn out with cares and infirmities, died at Croydon, the 5th of August 1633, aged 71 years; and was buried at Guildford, the place of his nativity, where he had endowed a hospital with lands to the amount of 300l. per annum. A stately monument was erected over the grave, with his effigy in his robes.

He proved himself, in most circumstances of his life, to be a man of great moderation to all parties; and was desirous that the clergy should gain the respect of the laity by the sanctity and purity of their manners, rather than claim it as due to their function. His opinions and principles, however, have drawn upon him many severe reflections; particularly, from the earl of Clarendon. But Dr Welwood has done more justice to his merit and abilities†. He wrote several tracts

Abbot.

* Fuller's
Church
Hist. cent.
xxvii. p. 87.

† Memoire,
vo. 1700,
upon p. 38.

Abbot
||
Abbots-
bury.

upon various subjects; and, as already mentioned, translated part of the New Testament, with the rest of the Oxford divines, in 1611.

There was another writer of the same name, who flourished somewhat later. This George Abbot wrote *A Paraphrase on Job*, *A Vindication of the Sabbath*, and *A Paraphrase on the Psalms*.

ABBOT, Robert, elder brother to the former, was born at Guildford in 1560, and completed his studies at Baliol college, Oxford. In 1582, he took his degree of master of arts, and soon became a celebrated preacher; and to this talent he chiefly owed his preferment. Upon the first sermon at Worcester, he was chosen lecturer in that city, and soon after rector of All-saints in the same place. John Stanhope, Esq. happening to hear him preach at Paul's-cross, was so pleased with him, that he immediately presented him to the rich living of Bingham in Nottinghamshire. In 1597, he took his degree of doctor in divinity: and, in the beginning of King James's reign, was appointed chaplain in ordinary to his majesty; who had such an opinion of him as a writer, that he ordered the doctor's book *De Antichristo* to be printed, with his own commentary upon part of the Apocalypse. In 1609, he was elected master of Baliol college; which trust he discharged with the utmost care and assiduity, by his frequent lectures to the scholars, by his continual presence at public exercises, and by promoting temperance in the society. In November 1610, he was made prebendary of Normanton in the church of Southwell; and, in 1612, his majesty appointed him regius professor of divinity at Oxford. The fame of his lectures became very great; and those which he gave upon the supreme power of kings, against Bellarmine and Suarez, so much pleased his majesty, that when the see of Salisbury became vacant, he named him to that bishopric, and he was consecrated by his own brother at Lambeth, December 3. 1615. When he came to Salisbury, he found the cathedral falling to decay, through the avarice and negligence of the clergy belonging to it; however, he found means to draw five hundred pounds from the prebendaries, which he applied towards repairing it. Here he devoted himself to the duties of his function with great diligence and assiduity, visiting his whole diocese in person, and preaching every Sunday. But his sedentary life, and close application to study, brought upon him the gravel and stone; of which he died on the 2d of March 1618, in the 58th year of his age; having filled the see only two years and three months. Dr Fuller*, speaking of the two brothers, says, "that George was the more plausible preacher, Robert the greatest scholar; George the abler statesman, Robert the deeper divine: gravity did frown in George, and smile in Robert." He published several pieces; and left behind him sundry manuscripts, which Dr Corbet presented to the Bodleian library.

ABBOTSBROMLEY, a town in Staffordshire. After the dissolution of the monasteries, it was given to the lord Paget; and has since been called *Paget's Bromley*. But it retains its old name in the king's books, and with regard to the fairs. W. Long. 1. 2. N. Lat. 52. 45.

ABBOTSBURY, a small town in Dorsetshire, in W. Long. 1. 17. N. Lat. 50. 40. The abbey near

this town was founded by a Norman lady, about the year 1026. Edward the Confessor and William the Conqueror were considerable benefactors to it.

ABBOTS-LANGLEY, a village in Herts, four miles from St Alban's, famous as the birth-place of Pope Adrian IV.

ABBREVIATE of ADJUDICATIONS, in *Scots Law*, an abstract or abridgment of a decret of adjudication, which is recorded in a register kept for that purpose.

ABBREVIATION, or ABBREVIATURE, a contraction of a word or passage, made by dropping some of the letters, or by substituting certain marks or characters in their place. A late philosophical writer on grammar, divides the parts of speech into words which are necessary for the communication of thought, as the noun and verb, and *abbreviations* which are employed for the sake of dispatch. The latter, strictly speaking, are also parts of speech, because they are all useful in language, and each has a different manner of signification. Mr Tooke, however, seems to allow that rank only to the necessary words, and to consider all others as merely substitutes of the first sort, under the title of abbreviations. They are employed in language in three ways; in terms, in sorts of words, and in construction. Mr Locke in his Essay treats of the first class; numerous authors have written on the last; and for the second class of abbreviations, see *Diversions of Purley*. Lawyers, physicians, &c. use many abbreviations, for the sake of expedition. But the Rabbins are the most remarkable for this practice, so that their writings are unintelligible without the Hebrew abbreviations. The Jewish authors and copyists do not content themselves with abbreviating words like the Greeks and Latins, by retrenching some of the letters or syllables; they frequently take away all but the initial letters. They even take the initials of several succeeding words, join them together, and, adding vowels to them, make a sort of barbarous words, representative of all those which they have thus abridged. Thus, *Rabbi Moses ben Maimon*, in their abbreviature is *Rambam*, &c.

The following ABBREVIATIONS are of most frequent occurrence in the Writings and Inscriptions of the Romans.

A

AB. Abdicavit.

AB. AUG. M. P. XXXXI. Ab Augustâ millia passuum quadraginta unum.

AB. AUGUSTOB. M. P. X. Ab Augustobrigâ millia passuum decem.

ABN. Abnepos.

AB. U. C. Ab urbe conditâ.

A. CAMP. M. P. XI. A Camboduno millia passuum undecim.

A. COMP. XIII. A Compluto quatuor decem.

A. C. P. VI. A capite, *vel* ad caput pedes sex.

A. D. Ante diem.

ADJECT. H-S. IX ∞. Adjectis sestertiis novem mille.

ADN. Adnepos.

ADQ. Adquiescit *vel* adquisita *pro* acquisita.

ÆD. II. II. VIR. II. Ædilis iterum, duum-vir iterum.

ÆD. II. VIR. QUINQ. Ædilis duum-vir quinquennialis.

ÆD.

* Heylin's
History of
Presbyterians,
p. 83.

Abbrevia-
tion.

ÆD. Q. II. VIR. Ædilis quinquennalis duum-vir.
 ÆL. Ælius, Ælia.
 ÆM. *vel* AIM. Æmilius, Æmilia.
 A. K. Ante kalendas.
 A. G. Animo grato : Aulus Gellius.
 AG. Ager, *vel* Agrippa.
 ALA. I. Ala prima.
 A. MILL. XXXV. A milliari triginta quinque, *vel*
 ad milliaria triginta quinque.
 A. M. XX. Ad milliare vigesimum.
 AN. A. V. C. Anno ab urbe conditâ.
 AN. C. H. S. Anno cent. hic situs est.
 AN. DCLX. Anno sexcentesimo sexagesimo.
 AN. II. S. Annos duos semis.
 AN. IVL. Annos quadraginta sex.
 AN. N. Annos natus.
 ANN. LIII. H. S. E. Annorum quinquagesim. trium
 hic situs est.
 ANN. NAT. LXVI. Annos natus sexaginta sex.
 ANN. PL. M. X. Annos *vel* annis plus minus decem.
 AN. O. XVI. Anno defunctus decimo sexto.
 AN. V. XX. Annos vixit viginti.
 AN. P. M. Annorum plus minus.
 A. XII. Annis duodecim.
 AN. P. M. L. Annorum plus minus quinquaginta.
 A. XX. H. EST. Annorum viginti hic est.
 AN. P. R. C. Anno post Romam conditam.
 AN. V. P. M. II. Annis vixit plus minus duobus.
 AN. XXV. STIP. VIII. Annorum viginti quinque
 stipendii, *vel* stipendiorum octo.
 A. P. M. Amico posuit monumentum.
 AP. Appia, Appius.
 A. P. V. C. Annorum post urbem conditam.
 APVD. L. V. CONV. Apud lapidem quintum con-
 venerunt.
 A. RET. P. III. S. Ante retropedes tres semis.
 AR. P. Aram posuit.
 ARG. P. X. Argenti pondo decem.
 ARR. Arrius.
 A. V. B. A viro bona.
 A. V. C. Ab urbe conditâ.

B

B. Balbus, Bulbius, Brutus, Belenus, Burrus.
 B. Beneficiario, beneficium, bonus.
 B. Balnea, beatus, bustum.
 B. *pro* V, berna *pro* verna, bixit *pro* vixit, bibo *pro* vi-
 vo, bictor *pro* victor, bidua *pro* vidua.
 B. A. Bixit annis, bonus ager, bonus amabilis, bona
 aurea, bonum aureum, bonis auguriis, bonis auspiciis.
 B. B. Bona bona, bene bene.
 B. DD. Bonis deabus.
 B. F. Bona fide, bona femina, bona fortuna, bene fac-
 tum.
 B. F. *reverscd thus*, q. J. Bona femina, bona filia.
 B. H. Bona hereditaria, bonorum hæreditas.
 B. I. I. Boni iudicis iudicium.
 B. L. Bona lex.
 B. M. P. Bene merito posuit.
 B. M. P. C. Bene merito ponendum curavit.
 B. M. S. C. Bene merito sepulcrum condidit.
 BN. EM. Bonorum emptores.
 BN. H. I. Bona hic invenies.
 B. RP. N. Bono reipublicæ natus.
 B. A. Bixit, *id est*, vixit annis.

BIGINTI, Viginti.

BIXIT. BIXSIT. BISSIT. Vixit.

BIX. ANN. XXCI. M. IV. D. VII. Vixit annis oc-
 toginta unum, mensibus quatuor, diebus septem.BX. ANVS. VII. ME. VI. DI. XVII. Vixit annos
 septem, menses sex, dies septem decim.

C

C. Cæsar, Caio, Caius, censor, civitas, consul, condem-
 no.
 C. C. Carissimæ conjugii, calumnia causa, consilium
 cepit.
 C. C. F. Caius Caii filius.
 C. B. Commune bonum.
 C. D. Comitialibus diebus.
 C. H. Custos hortorum *vel* hæredum.
 C. I. C. Caius Julius Cæsar.
 CC. VV. Clarissimi viri.
 CEN. Censor, centuria, centurio.
 CERTA. QUINQ. ROM. CO. Certamen quinquen-
 nale Romæ conditum.
 CL. Claudius.
 CL. V. Clarissimus vir.
 CH. COH. Cohors.
 C. M. *vel* CA. M. Causa mortis.
 CN. Cneus.
 C. O. Civitas omnis.
 COH. I. *vel* II. Cohors prima *vel* secunda.
 COS. ITER. ET. TERT. DESIG. Consul iterum et
 tertium designatus.
 COS. TER. *vel* QUAR. Consul tertium, *vel* quartum.
 COSS. Consules.
 COST. CUM. LOC. H-S. ∞ D. Custodiam cum loca-
 sestertiis mille quingentis.
 C. R. Civis Romanus.
 CS. IP. Cæsar imperator.
 C. V. Centum viri.

D

D. Decius, decimus, decuria, decurio, dedicavit, dedit,
 devotus, dies, divus, Deus, dii, Dominus, domus,
 donum, datum, decretum, &c.
 D. A. Divus Augustus.
 D. B. I. Diis bene juvantibus.
 D. B. S. De bonis suis.
 DCT. Detractum.
 DDVIT. Dedicavit.
 D. D. Donum dedit, datis, datio, Deus dedit.
 D. D. D. Dono dederunt, *vel* datum decreto decurio-
 num.
 D. D. D. D. Dignum Deo donum dedicavit.
 DDPP. Depositi.
 D. D. Q. O. H. L. S. E. V. Diis deabusque omnibus
 hunc locum sacrum esse voluit.
 DIG. M. Dignus memoria.
 D. M. S. Diis manibus sacrum.
 D. O. M. Deo optimo maximo.
 D. O. Æ. Deo optimo æterno.
 D. PP. Deo perpetuo.
 DR. Drusus.
 DR. P. Dare promittit.
 D. RM. De Romanis.
 D. RP. De republica.
 D. S. P. F. C. De sua pecunia faciendum curavit.
 DT. Duntaxat.
 DVL. *vel* DOL. Dulcissimus.

Abbrevia-
tion.

Abbrevia-
tion.

DEC. *XIII. AVG. XII. POP. XI. Decurionibus denariis tredecim, augustalibus duodecim, populo undecim.
D. II. ID. Die quartâ idus.
D. VIII. Diebus novem.
D. V. ID. Die quintâ idus.

E

E. Ejus, ergo, esse, est, erexit, exactum, &c.
E. C. F. Ejus causa fecit.
E. D. Ejus domus.
ED. Edictum.
E. E. Ex edicto.
EE. N. P. Esse non potest.
EG. Egit, egregius.
E. H. Ejus hæres.
EID. Idus.
EIM. Ejusmodi.
E. L. Ea lege.
E. M. Elexit *vel* erexit monumentum.
EQ. M. Equitum magister.
EQ. O. Equester ordo.
EX. A. D. K. Ex antè diem kalendas.
EX. A. D. V. K. DEC. AD. PRID. K. IAN. Ex antè diem quinto kalendas Decembris ad pridie kalendas Januarias.
EX. H-S. X. P. F. I. Ex sestertiis decem parvis fieri jussit.
EX. H-S. CION. Ex sestertiis mille nummum.
EX. H-S. ∞ ∞ ∞ ∞ Ex sestertiis quatuor millia.
EX. H-S. N. CC. L. ∞ D. XL. Ex sestertiis nummorum ducentis quinquaginta millibus, quingentis quadraginta.
EX. H-S. DC. ∞ D. XX. Ex sestertiis sexcentis millibus quingentis viginti.
EX. KAL. IAN. AD. KAL. IAN. Ex kalendis Januarii ad kalendas Januarii.

F

F. Fabius, fecit, factum, faciendum, familia, famula, fastus, Februarius, feliciter, felix, fides, fieri, fit, femina, filia, filius, frater, finis, flamen, forum, fluvius, faustum, fuit.
F. A. Filio amantissimo *vel* filiæ amantissimæ.
F. AN. X. F. C. Filio *vel* filiæ annorum decem faciendum curavit.
F. C. Fieri *vel* faciendum curavit, fidei commissum.
F. D. Flamen Dialis, filius dedit, factum dedicavit.
F. D. Fide jussor, fundum.
FEA. Femina.
FE. C. Fermè centum.
FF. Fabrè factum, filius familias, fratris filius.
F. F. F. Ferro, flamma, fame, fortior, fortuna, fato.
FF. Fecerunt.
FL. F. Flavii filius.
F. FQ. Filiis filiabusque.
FIX. ANN. XXXIX. M. I. D. VI. HOR. SCIT. NEM. Vixit annos triginta novem, mensem unum, dies sex, horas scit nemo.
FO. FR. Forum.
F. R. Forum Romanum.

G

G. Gellius, Gaius *pro* Caius, genius, gens, gaudium, gesta, gratia, gratis, &c.
GAB, Gabinius.
GAL. Gallus, Gallerius.
G. C. Genio civitatis.
GEN. P. R. Genio populi Romani.
GL. Gloria.

GL. S. Gallus Sempronius.
GN. Gneus *pro* Cneus, genius, gens.
GNT. Gentes.
GRA. Gracchus.
GRC. Græcus.

H

H. Hic, habet, hastatus, hæres, homo, hora, hostis, herus.
H. A. Hoc anno.
HA. Hadrianus.
HC. Hunc, huic, hic.
HER. Hæres, hereditatis, Herennius.
HER. *vel* HERC. S. Herculi sacrum.
H. M. E. H-S. CCICCC. CCICCC. ICCC. M. N. Hoc monumentum erexit sestertiis viginti quinque mille nummum.
H. M. AD. H. N. T. Hoc monumentum ad hæres non transit.
H. O. Hostis occisus.
HOSS. Hostes.
H. S. Hic situs *vel* sita, sepultus *vel* sepulta.
H-S. N. III. Sestertiis nummum quatuor.
H-S. CCCC. Sestertiis quatuor centum.
H-S. ∞. N. Sestertiis mille nummum.
H-S. ∞. CCICCC. N. Sestertiis novem mille nummum.
H-S. CCICCC. CICC. Sestertiis viginti mille.
H-S. XXM. N. Sestertiis viginti mille nummum.
H. SS. Hic supra scriptis.

I

I. Junius, Julius, Jupiter, ibi, idest, immortalis, imperator, inferi, inter, invenit, invictus, ipse, iterum, judex, jussit, jus, &c.
IA. Intra.
I. AG. In agro.
I. AGL. In angulo.
IAD. Jamdudum.
IAN. Janus.
IA. RI. Jam respondi.
I. C. Juris consultus, Julius Cæsar, judex cognitionum.
IC. Hic.
I. D. Inferiis diis, Jovi dedicatum, Isidi deæ, jussu deæ.
ID. Idus.
I. D. M. Jovi Deo magno.
I. F. *vel* I. FO. In foro.
IF. Interfuit. IFT. Interfuerunt.
I. FNT. In fronte.
IG. Igitur.
I. H. Jacet hic.
I. I. In jure.
IM. Imago, immortalis, imperator.
I. M. CT. In medio civitatis.
IMM. Immolavit, immortalis, immunis.
IM. S. Impensis suis.
IN. Inimicus, inscripsit, interea.
IN. A. P. XX. In agro pedes viginti.
IN. *vel* INL. V. I. S. Illustris vir infrâ scriptus.
I. R. Jovi regi, Junoni reginæ, jure rogavit.
I. S. *vel* I. SN. In senatum.
I. V. Justus vir.
IVD. Judicium.
IVV. Juventus, Juvenalis.
II. V. Duum-vir, *vel* duum-viri.
III. V. *vel* III. VIR. Trium-vir, *vel* trium-viri.
IIII. Vir. Quatuor-vir, *vel* quatuor-viri, *vel* quatuor viratus.

Abbrevia-
tion.

Abbrevia-
tion.

IIII. V. *vel* VIR. Sextum-vir, *vel* se-vir, *vel* sex-vir.
IDNE, *vel* IND. *aut* INDICT. Indictio, *vel* indica-
tione.

K

K. Cæso, Caius, Caio, Cælius, Carolus, calumnia, can-
didatus, caput, carissimus, clarissimus, castra, cohors,
Carthago, &c.

K. KAL. KL. KLD. KLEND. Kalendæ, *aut* ka-
leudis; *et sic de cæteris ubi mensium apponuntur no-
mina.*

KARC. Carcer.

KK. Carissimi.

KM. Carissimus.

K. S. Carus suis.

KR. Chorus.

KR. AM. N. Carus amicus noster.

L

L. Lucius, Lucia, Lælius, Lollius, lares, Latinus, la-
tum, legavit, lex, legio, libens *vel* lubens, liber, li-
bera, libertus, liberta, libra, locavit, &c.

L. A. Lex alia.

LA. C. Latini coloni.

L. A. D. Locus alteri datus.

L. AG. Lex agraria.

L. AN. Lucius Annius, *vel* quinquaginta annis.

L. AP. Ludi Apollinares.

LAT. P. VIII. E. S. Latum pedes octo et semis.

LONG. P. VII. L. P. III. Longum pedes septem, la-
tum pedes tres.

L. ADQ. Locus adquisitus.

LB. Libertus, liberi.

L. D. D. D. Locus datus decreto decurionum.

LECTIST. Lectisternium.

LEG. I. Legio prima.

L. E. D. Lege ejus damnatus.

LEG. PROV. Legatus provinciae.

LIC. Licinius.

LICT. Lictor.

LL. Libentissimè, liberi, libertas.

L. L. Sestertius magnus.

LVD. SÆC. Ludi sæculares.

LVPERC. Lupercalia.

LV. P. F. Ludos publicos fecit.

M

M. Marcus, Marca, Martius, Mutius, maceria, magi-
ster, magistratus, magnus, manes, mancipium, mar-
moreus, marti, mater, maximus, memor, memoria,
mensis, meus, miles, militavit, militiâ, mille, missus,
monumentum, mortuus, &c.

MAG. EQ. Magister equitum.

MAR. VLT. Mars ultor.

MAX. POT. Maximus pontifex.

MD. Mandatum.

MED. Medicus, medius.

MER. Mercurius, mercator.

MERK. Mercurialia, mercatus.

MES. VII. DIEB. XI. Mensibus septem, diebus un-
decim.

M. I. Maximo Jovi, matri Idæe *vel* Isidi, militiæ jus,
monumentum jussit.

MIL. COH. Miles cohortis.

MIN. *vel* MINER. Minerva.

M. MON. MNT. MONET. Moneta.

M. *vel* MS. Mensis *vel* menses.

MNF. Manifestus.

MNM. Manumissus.

M. P. II. Millia passuum duo.

MV. MN. MVN. MVNIC. Municipium *vel* muni-
ceps.

N

N. Neptunus, Numerius, Numeria, Nonis, Nero, nam,
non, natus, natio, nefastus, nepos, neptis, niger, no-
men, nonæ, noster, numerarius, numerator, numerus,
nummus *vel* numisma, numen.

NAV. Navis.

N. B. Numeravit bivos *pro* vivos.

NB. *vel* NBL. Nobilis.

N. C. Nero Cæsar, *vel* Nero Claudius.

NEG. *vel* NEGOT. Negotiator.

NEP. S. Neptuno sacrum.

N. F. N. Nobili familia natus.

N. L. Non liquet, non licet, non longè, nominis Latini.

N. M. Nonius Macrinus, non malum, non minus.

NN. Nostri. NNR. *vel* NR. Nostrorum.

NO. Nobis.

NOBR. November.

NON. AP. Nonis Aprilis.

NQ. Namque, nusquam, nunquam.

N. V. N. D. N. P. O. Neque vendetur, neque dona-
bitur, neque pignori obligabitur.

NVP. Nuptiæ.

O

O. Officium, optimus, olla, omnis, optio, ordo, ossa, os-
tendit, &c.

OB. Obiit.

OB. C. S. Ob cives servatos.

OCT. Octavianus, October.

O. E. B. Q. C. Ossa ejus benè quiescant condita.

O. H. F. Omnibus honoribus functus.

ONA. Omnia.

OO. Omnes, omnino. O. O. Optimus ordo.

OP. Oppidum, opiter, oportet, optimus, opus.

OR. Ornamentum.

OTIM. Optimæ.

P

P. Publius, passus, patria, pecunia, pedes, perpetuus,
pius, plebs, populus, potifex, posuit, potestas, præ-
ses, prætor, pridie, pro, post, provincia, puer, publi-
cus, publicè, primus, &c.

PA. Pater, Patricius.

PAE. ET. ARR. COS. Pæto et Arrio consulibus.

P. A. F. A. Postulo an fias auctor.

PAR. Parens, parilia, Parthicus.

PAT. PAT. Pater patriæ.

PBLC. Publicus.

PC. Procurator.

P. C. Post consulatum, patres conscripti, patronus co-
loniæ, ponendum curavit, præfectus corporis, pactum
conventum.

PED. CXVS. Pedes centum quindecim semis.

PEG. Peregrinus.

P. II. ∞. L. Pondo duarum semis librarum.

P. II. :: Pondo duo semis et triente.

P. KAL. Pridie kalendas.

POM. Pompeius.

P. P. P. C. Propria pecunia ponendum curavit.

P. R. C. A. DCCCXLIIII. Post Romam conditam
annis octingentis quadraginta quatuor.

PRO. Proconsul. P. PR. Pro-prætor. P. PRR. Pro-
prætores.

Abbrevia-
tion

Abbrevia-
tion.

PR. N. Pro nepos.
P. R. V. X. Populi Romani vota decennalia.
PS. Passus, plebiscitum.
PUD. Pudicus, pudica, pudor.
PUR. Purpureus.

Q

Q. Quinquennalis, quartus, quintus, quando, quantum, qui, quæ, quod, Quintus, Quintius, Quintilianus, quæstor, quadratum, quæsitus.
Q. B. AN. XXX. Qui bixit, *id est* vixit, annos triginta.
QM. Quomodo, quem, quoniam.
QQ. Quinquennalis. QQ. V. Quoquo versum.
Q. R. Quæstor reipublicæ.
Q. V. A. III. M. II. Qui *vel* quæ vixit annos tres, menses duo.

R

R. Roma, Romanus, rex, reges, Regulus, rationalis, Ravennæ, recta, recto, requietorium, retro, rostra, rudera, &c.
RC. Rescriptum.
R. C. Romana civitas.
REF. C. Reficiendum curavit.
REG. Regio.
R. P. RESP. Respublica.
RET. P. XX. Retro pedes viginti.
REC. Requiescit.
RMS. Romanus.
ROB. Robigalia, Robigo.
RS. Responsum.
RVF. Rufus.

S

S. Sacrum, sacellum, scriptus, semis, senatus, sepultus, sepulcrum, sanctus, servus, serva, Servius, sequitur, sibi, sita, solvit, sub, stipendium, &c.
SAC. Sacerdos sacrificium.
SÆ. *vel* SÆC. Sæculum, sæculares.
SAL. Salus.
S. C. Senatus-consultum.
SCI. Scipio.
S. D. Sacrum diis.
S. EQ. Q. O. ET. P. R. Senatus, equesterque ordo et populus Romanus.
SEMP. Sempronius.
SL. SVL. SYL. Sylla.
S. L. Sacer ludus, sine linguâ.
S. M. Sacrum manibus, sine manibus, sine malo.
SN. Senatus, sententia, sine.
S. P. Sine pecunia.
S. P. Q. R. Senatus populusque Romanus.
S. P. D. Salutem plurimam dicit.
S. T. A. Sine *vel* sub tutoris auctoritate.
SLT. Scilicet.
S. E. T. L. Sit ei terra levis.
SIC. V. SIC. X. Sicut quinquennalia, sic decennalia.
SSTVP. XVIII. Stipendiis novem decim.
ST. XXXV. Stipendiis triaginta quinque.

T

T. Titus, Tullius, tantum, terra, tibi, ter, testamentum, titulus, terminus, triarius, tribunus, turma, tutor, tutela, &c.
TAB. Tabula. TABVL. Tabularius.
TAR. Tarquinius.
TB. D. F. Tibi dulcissimo filio.
TB. PL. Tribunus plebis.
TB. TI. TIB. Tiberius.

Abbrevia-
tion.

T. F. Titus Flavius, Titi filius.
THR. Thrax.
T. L. Titus Livius, Titi libertus.
TIT. Titulus.
T. M. Terminus, thermæ.
TR. PO. Tribunitia potestas.
TRAJ. Trajanus.
TUL. Tullus *vel* Tullius.
TR. V. Trium-vir.
TT. QTS. Titus Quintus.
Θ *vel* TH. AN. Mortuus anno.
ΘXIII. Defunctus viginti tribus.

V

V. Quinque, quintò, quintum.
V. Vitellius, Volera, Volero, Volusus, Vopiscus, valeo; Vesta, vestalis, vestis, vester, veteranus, vir, virgo, vivus, vixit, votum, vovit, urbs, usus, uxor, victus, victor, &c.
V. A. Veterano assignatum.
V. A. I. D. XI. Vixit annum unum, dies undecim.
V. A. L. Vixit annos quinquaginta.
V. B. A. Viri boni arbitrati.
V. C. Vale conjux, vivens curavit, vir consularis, vir clarissimus, quintum consul.
VDL. Videlicet.
V. E. Vir egregius, visum est, verum etiam.
VESP. Vespasianus.
VI. V. Sextum-vir. VII. V. Septem-vir. VIII. VIR. octum-vir.
VIX. A. FF. C. Vixit annos ferme centum.
VIX. AN. $\frac{X}{X}$. Vixit annos triginta.
ULPS. Ulpianus, Ulpus.
V. M. Vir magnificus, vivens mandavit, volens merito.
V. N. Quinto nonas.
V. MUN. Vias munivit.
VOL. Volcania, Voltinia, Volusus.
VONE. Bonæ.
VOT. V. Votis quinquennialibus.
VOT. V. MULT. X. Votis quinquennialibus, multis decennialibus.
VOT. X. Vota decennalia.
VOT. XX. *vel* XXX. *vel* XXXX. Vota vicennalia, aut tricennalia, aut quadragenalia.
V. R. Urbs Roma, votum reddidit.
VV. CC. Viri clarissimi.
UX. Uxor.

X

X. AN. Annalibus decennialibus.
X. K. OCT. Decimo kalendas Octobris.
X. M. Decem millia. X P. Decem pondo.
X. V. Decem vir. XV. VIR. Quindecim-vir.

ABBREVIATION of fractions, in *Arithmetic* and *Algebra*, is the reducing them to lower terms.

ABBREVIATOR, in a general sense, a person who abridges any large book into a narrower compass.

ABBREVIATORS, a college of 72 persons in the chancery of Rome, who draw up the pope's briefs, and reduce petitions, when granted by him, into proper form for being converted into bulls.

ABB'S (ST) HEAD, a promontory of land in the southern extremity of the frith of Forth, in Scotland, 10 miles north of Berwick, and nearly the same distance

Abb's stance south of Dunbar. W. Long. 2. 15. N. Lat. 55. 52.

Abdalonymus.

ABBUTALS, signify the buttings or boundings of land towards any point. Limits were anciently distinguished by artificial hillocks, which were called *bote-mines*; and hence *butting*. In a description of the site of land, the sides on the breadth are more properly *adjacentes*, and those terminating the length are *abbutantes*; which, in old surveys, were sometimes expressed by *capitare*, to head, whence abbutals are now called *head lands*.

ABCEADARY, or ABCEADARIAN, an epithet given to compositions, the parts of which are disposed in the order of the letters of the alphabet: thus we say, Abceadarian psalms, lamentations, hymns, &c.; such are Psal. xxv. xxxiv. cxix. &c.

AB COURT, a town near St Germans, four leagues from Paris. Here is a brisk chalybeate water, which is also impregnated with carbonic acid and soda; and resembling the waters of Spa and Ilmington.

ABDALLA, the son of Abdalmotaleb, was the father of the prophet Mahomet. He was the most beautiful and modest of the Arabian youth, and when he married Amina, of the noble race of the Zahrites, 200 virgins are said to have died of jealousy and despair. Several other Arabians of eminence bore the same name.

ABDALMALEK, the son of Mirvan, and the 5th caliph of the race of the Omniades. He surpassed all his predecessors in power and dominion; for in his reign the Indies were conquered in the east, and his armies penetrated Spain in the west: he likewise extended his empire toward the south, by making himself master of Medina and Mecca. Under his reign the Greek language and character were excluded from the accounts of the public revenue. If this change, says Gibbon, was productive of the invention or familiar use of the Arabic or Indian cyphers, which are our present numerals, a regulation of office has promoted the most important discoveries of arithmetic, algebra, and the mathematical sciences. His extreme avarice exposed him to the contempt and derision of his subjects, who gave him the appellation of *the sweat of a stone*; and his fetid breath, it is said, poisoned the flies which accidentally lighted on his lips, whence he was called the *father of flies*. He began his reign in the 65th of the Hegira, A. D. 684; reigned 15 years; and four of his sons successively enjoyed the caliphate.

ABDALMALEK, *Ben Zohar*, an eminent physician, commonly called by the Europeans *Avenzoar*. See AVENZOAR.

ABDALMOTALLEB, or ABDOL MOTALLEB, the son of Hashem, the father of Abdalla, and grandfather of Mahomet the prophet of the Mussulmans, was, it is said, of such wonderful comeliness and beauty, that all women who saw him became enamoured: which may have given occasion to that prophetic light, which, according to the Arabians, shone on the foreheads of him, his ancestors, and descendants; it being certain that they were very handsome and graceful men. He died when Mahomet, of whom he had taken peculiar care, was only eight or nine years old; aged, according to some 110, and according to other writers 120.

ABDALONYMUS, or ABDOLONYMUS, in classic history, of the royal family of Sidon, and descended

from King Cinyras, lived in obscurity, and subsisted by cultivating a garden, while Strato was in possession of the crown of Sidon. Alexander the Great having deposed Strato, inquired whether any of the race of Cinyras was living, that he might set him on the throne. It was generally thought that the whole race was extinct: but at last Abdalonymus was thought of, and mentioned to Alexander; who immediately ordered some of his soldiers to fetch him. They found the good man at work, happy in his poverty, and entirely a stranger to the noise of arms, with which all Asia was at that time disturbed; and they could scarcely persuade him they were in earnest. Alexander was convinced of his high descent by the dignity of his person; but was desirous of learning from him in what manner he bore his poverty. "I wish," said Abdalonymus, "I may bear my new condition as well: These hands have supplied my necessities: I have had nothing, and I have wanted nothing." This answer pleased Alexander so much, that he not only bestowed on him all that belonged to Strato, but augmented his dominions, and gave him a large present out of the Persian spoils.

ABDALS, in the eastern countries, a kind of saints supposed to be inspired to a degree of madness. The word is perhaps derived from the Arabic, *Abdallah*, the servant of God. The Persians call them *devaneh khoda*, similar to the Latin way of speaking of prophets and sibyls, q. d. *furantes deo*, raging with the god. Hurried on by excess of zeal, especially in the Indies, they often run about the streets, and kill all they meet who are of a different religion. The English sailors call this *running a muck*, from the name of the instrument, a sort of poniard, which they employ on those desperate occasions. If they are killed, as it commonly happens before they have done much mischief, they reckon it highly meritorious; and are esteemed, by the vulgar, martyrs for their faith.

ABDARA, or ABDERA, in *Ancient Geography*, a town of Bætica in Spain, a Phœnician colony; now *Adra*, to the west of Almeira in the kingdom of Granada.

ABDERA, in *Ancient Geography*, a maritime town of Thrace, not far from the mouth of the river Nessus, on the east side. The foundation, according to Herodotus, was attempted to be laid by Timesius the Clazomenian; but he was forced by the Thracians to quit the design. The Teians undertook it and succeeded, and settled in this place, in order to avoid the insults and oppression of the Persians.—Several singularities are told of Abdera*. The grass of the country round it was of such a quality, that the horses which fed on it were seized with madness. In the reign of Cassander king of Macedon, this city was so infested with frogs and rats, that the inhabitants were forced for a time to quit it.—The Abderites, or Abderitani, were very much derided for their want of wit and judgment: yet their city has given birth to several eminent persons; as Protagoras, Democritus, Anaxarchus, Hecateus the historian, Nicæus the poet, and many others, who were mentioned among the illustrious men.—In the reign of Lysimachus, Abdera was afflicted for some months with a most extraordinary disease†: this was a burning fever, whose crisis was always on the seventh day, and then it left them; but it so distracted their imaginations, that they fancied themselves players. After this, they were ever repeating verses from some tragedy, and particularly

Abdalonymus
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Abdera.

* Plin. lib. xxv. c. 3.
Just. lib. xxv. c. 2.

† Lucianus, quomodo Hist. sit conscribens initio.

Abdera from the Andromeda of Euripides, as if they had been upon the stage; so that many of these pale meagre actors were pouring forth their tragic exclamations in every street. This delirium continued till the winter following; which was a very cold one, and therefore fitter to remove it. Lucian, who has described this disease, endeavours to account for it in this manner: Archelaus, an excellent player, acted the Andromeda of Euripides before the Abderites, in the height of a very hot summer. Several had a fever at their coming out of the theatre; and as their imaginations were full of the tragedy, the delirium which the fever raised perpetually represented Andromeda, Perseus, Medusa, &c. and the several dramatic incidents, and called up the ideas of those objects, and the pleasure of the representation, so strongly, that they could not forbear imitating Archelaus's action and declamation: And from these the fever spread to others by infection.

ABDERAHMA, a Saracen viceroy in Spain, who revolted and formed an independent principality at Cordova. He had several successors of the same name.

A viceroy and captain-general of this name led the Saracens and their followers into France, ravaging the country wherever they came. At length he was met at Tours by Charles Martel, who had received reinforcements of Germans and Gepidæ; and after many skirmishes, the Saracen army, in a general action, was totally routed, and Abderahma was killed with 370,000 Moors. This great event, which first broke the power of the Saracens, and taught the Europeans that they were not invincible, happened about the year 732 of the Christian era, and of the Hegira 114.

ABDEST, a Persian word, properly signifying the water placed in a basin for washing the hands; but is used to imply the legal purifications practised by the Mahometans before prayer, entering the mosque, or reading the Alcoran.

ABDIAS OF BABYLON, one of the boldest legend writers, who boasted that he had seen Christ, that he was one of the 70 disciples, had been eye-witness of the actions and prayers of several of the apostles at their deaths, and had followed into Persia St Simon and St Jude, who, he said, made him the first bishop of Babylon. His book, entitled *Historia Certaminis Apostolici*, was published by Wolfgang Lazius, at Basil, 1551; and has passed through several editions in other places.

ABDICATION, the action whereby a magistrate, or person in office, renounces and gives up the same before the term of service is expired.

This word is frequently confounded with *resignation*; but differs from it: for abdication is done purely and simply, whereas resignation is in favour of some third person. In this sense, Dioclesian is said to have abdicated the crown; Philip IV. of Spain resigned it. It is said to be a renunciation, quitting, and relinquishing, so as to have nothing further to do with a thing; or the doing of such actions as are inconsistent with the holding of it. On King James's leaving the kingdom, and abdicating the government, the lords proposed that the word *desertion* should be employed; but the commons thought that it was not sufficiently comprehensive. Among the Roman writers it is more particularly used for the act whereby a father discar-

ed or disclaimed his son, and expelled him the family. **Abdication**, It is distinguished from *exheredatio* or *disinheriting*, in that the former was done in the father's lifetime; the latter, by will at his death: so that whoever was abdicated, was also disinherited; but not *vice versa*. **Abdolla-tiph**.

ABDOLLATIPH, a physician, was born at Bagdad in the 557th year of the Hegira, A. D. 1167. Having been educated with the greatest care by his father, who was himself a man of learning, and resided in a capital which abounded with the best opportunities of instruction, he early distinguished himself not only by proficiency in rhetoric, history, and poetry, but also in the more severe studies of Mohammedan theology. To the acquirement of medical knowledge he applied with especial diligence; and it was chiefly with this view that, in his 28th year, he left Bagdad, in order to visit other countries. At Mosul, in Mesopotamia, whither he first directed his course, he found the attention of the students entirely confined to the chemistry of that day, with which he was already sufficiently acquainted. Having spent a year at Mosul, he removed to Damascus in Syria, where the grammarian Al Kindi then enjoyed the highest reputation; and with whom he is said to have engaged in a controversy on some subjects of grammar and philology, which terminated in favour of Abdollatiph.

At this time, Egypt had yielded to the arms of Saladin, who was marching against Palestine for the purpose of wresting that country from the hands of the Christians: yet towards Egypt Abdollatiph was irresistibly impelled by that literary curiosity which so strongly marked his character. To the successful prosecution of this journey, the consent and patronage of the sultan were indispensably necessary: but when the Arabian physician arrived at the camp near Acca, (the ancient Ptolemais, now Acre) to solicit his powerful protection, he found the Saracens bemoaning a defeat which they had recently experienced; a defeat so honourable to the skill and valour of our English Richard, that nothing less than the late matchless defence of this fortress, by a handful of British seamen and marines, could have detracted from its importance, or eclipsed its glory. Hence the lofty spirit of the sultan was plunged into a morbid melancholy, which excluded the traveller from his presence; but the favours which he received evinced the munificence of Saladin, and he persisted in his design of exploring the wonders of Egypt. One strong inducement which influenced him on this occasion, was the instruction which he hoped to derive from the society of the celebrated Maimonides; and by Al Kadi Al Fadel, who had earnestly but unavailingly solicited him to return to Damascus, he was furnished with such recommendations as procured for him the most flattering reception at Cairo. His talents and his virtues confirmed and increased the kindness with which he was welcomed on his first arrival; and the Egyptians of the highest rank continued to vie with each other in cultivating his friendship.

From this intercourse, however, with the great and the learned, Abdollatiph withdrew, in order to present himself before the sultan; who, having concluded a truce with the Franks, then resided in the Holy City. Here he was received by Saladin with every expression of esteem for his character and attainments.

Abdolla-
tiph
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Abdomina-
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To a dignified politeness, and condescending freedom, this prince is said to have added a munificent liberality in the patronage of science and of art; and of this fact, indeed, we have a laudable instance in the pension which he granted to Abdollatiph, and which amounted to 30 dinars per month. After the death of the sultan, this sum was raised by his sons to 100 dinars, till the ambition of their uncle forced them from the throne of Egypt and of Syria; and thus was our traveller compelled to resort again to Damascus, after a short abode at Jerusalem: where his lectures, and his treatises were equally the objects of general admiration.

In the capital of Syria, his pursuits were of the same nature, and attended with similar success. His practice as a physician was extensive. To the students in the college of Al Aziz, he freely communicated the ample stores of his cultivated mind; and in the works which he composed on the principles of medicine, he displayed that depth of research and that felicity of illustration, which are the rare effects of genius combined with diligence, judgment, and erudition.

Such is the testimony given to the exertions of our author; and it is added that they were rewarded at Damascus not with fame alone, but also with riches. Yet neither the applause of the wise nor the patronage of the wealthy had power to detain him, when other scenes or other society promised to gratify his curiosity, or to increase his knowledge. On this account probably, he left Damascus, and, after having visited Aleppo, resided several years in Greece. With the same view he travelled through Syria, Armenia, and Asia Minor, still adding to the number of his works; many of which he dedicated to the princes whose courts he visited, or whose subjects he laboured to instruct.

After having thus enriched his own mind, and contributed so successfully to the improvement of others, sentiments of devotion induced him to undertake a pilgrimage to Mecca. In the mean time, however, he seems to have experienced the full force of that desire, which in the native of Switzerland has often been known to supersede every other,—the desire of once more beholding the place which gave him birth. He wished also to present the fruits of his travels, and of his studies, to the caliph Al Mostanser Billah. He therefore eagerly journeyed towards Bagdad, which, after so long an absence, he no doubt beheld with emotions of tender exultation: but scarcely had he reached it when he was suddenly taken ill, and died in his 63d year, A. D. 1223. Of 150 treatises which he composed on various subjects of medicine, natural philosophy and polite literature, only one, entitled *Historiæ Ægypti Compendium*, has survived the ravages of time. This manuscript, the only one which has been discovered, was brought to Europe by the celebrated orientalist Pococke, and is now preserved in the Bodleian library. Dr White of Oxford published an edition of the original Arabic, with an elegant Latin version in 4to, in 1800. See ABDALLATIF, SUPPLEMENT.

ABDOMEN, in *Anatomy*, is that part of the trunk of the body which lies between the thorax and the bottom of the pelvis. See ANATOMY.

ABDOMINALIS, or ABDOMINAL FISHES, con-

stitute the Fourth Order of the *Fourth Class* of Animals, in the Linnæan system. See ICHTHYOLOGY.

ABDUCTION, in *Logic*, a kind of argumentation, by the Greeks called *apagoge*, wherein the greater extreme is evidently contained in the medium, but the medium not so evidently in the lesser extreme as not to require some farther medium or proof to make it appear. It is called *abduction*, because, from the conclusion, it draws us on to prove the proposition assumed. Thus, in the syllogism, "All whom God absolves are free from sin; but God absolves all who are in Christ; therefore all who are in Christ are free from sin,"—the major is evident; but the minor, or assumption, is not so evident without some other proposition to prove it, as, "God received full satisfaction for sin by the sufferings of Jesus Christ."

ABDUCTOR, or ABDUCENT, in *Anatomy*, a name given to several of the muscles, on account of their serving to withdraw, open, or pull back the parts to which they belong.

ABEL, second son of Adam and Eve, was a shepherd. He offered to God some of the firstlings of his flock, at the same time that his brother Cain offered the fruits of the earth. God was pleased with Abel's oblation, but displeased with Cain's; which so exasperated the latter, that he rose up against his brother and killed him. These are the only circumstances Moses relates of him; though, were we to take notice of the several particulars to which curiosity has given birth on this occasion, they would run to a very great length. But this will not be expected. It is remarkable, that the Greek churches, who celebrate the feasts of every other patriarch and prophet, have not done the same honour to Abel. His name is not to be found in any catalogue of saints or martyrs till the 10th century; nor even in the new Roman martyrology. However he is prayed to, with some other saints, in several Roman litanies said for persons who lie at the point of death.

ABEL-Keramim, or *Vincarum*, beyond Jordan, in the country of the Ammonites, where Jephthah defeated them, seven miles distant from Philadelphia; abounding in vines, and hence the name. It was also called *Abela*.

ABEL-Meholah, the country of the prophet Elisha, situated on this side Jordan, between the valley of Jezreel and the village Bethmael, in the plains of Jordan, where the Midianites were defeated by Gideon. Judges vii. 22.

ABEL Mizraim, (called also the Threshing-floor of Atad), signifying the lamentation of the Egyptians; in allusion to the mourning for Jacob, Gen. i. 3, 10, 11. Supposed to be near Hebron.

ABEL-Mosch, or *Abelmusch*, in *Botany*, the trivial name of a species of the HIBISCUS.

ABEL-Sattim, or *Sittim*, a town in the plains of Moab, to the north-east of the Dead sea, not far from Jordan, where the Israelites committed fornication with the daughters of Moab: So called, probably, from the great number of sittim trees there.

ABELARD, PETER, an eminent scholastic philosopher of France, the son of Berenger, of noble descent, was born at Palais near Nantes in Bretagne, in the year 1079. Abelard had received from nature a vigorous and active mind; but it was his lot to live at a period, when logic, metaphysics, and polemic theology,

Abdomina-
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Abelard.

Abelard.

logy, constituted a learned education, when abstruse speculations and verbal subtleties occupied the ingenuity of literary men, and distinguished talents for disputation led to honour and preferment. Devoted to letters by his father's appointment, and by his own inclination, his literary attainments could at this time only be exhibited in the field of scholastic philosophy; and, that he might be fitted for his destined career of life, he was placed, after a previous course of grammatical studies, under the tuition of Rosceline, a celebrated metaphysician, and founder of the sect of the Nominalists. Under the instructions of this able master, at the early age of sixteen, he furnished himself with a large store of scholastic knowledge, and acquired a subtlety and quickness of thought, a fluency of speech, and facility of expression, which were necessary qualifications in scholastic disputation.

Having spent some time in visiting the schools of several provinces, after the example of the ancient philosophers who travelled in search of wisdom, in the twentieth year of his age he fixed his residence in the university of Paris, then the first seat of learning in Europe. The master, William de Champeaux, was at that time in high repute for his knowledge of philosophy, and his skill in the dialectic art; to him he committed the direction of his studies, and was at first contented with receiving instruction from so eminent a preceptor. De Champeaux was proud of the talents of his pupil, and admitted him to his friendship. But the aspiring youth ventured to contradict the opinions of his master, and in the public school held disputations with him, in which he was frequently victorious. The jealousy of the master and the vanity of the pupil naturally occasioned a speedy separation.

Elated by success, and confident of his own powers, Abelard, without hesitation, at the age of twenty-two, opened a public school of his own. "I was young indeed," says he; "but confident of myself, my ambition had no bounds: I aspired to the dignity of a professor, and only waited till I could fix on a proper place to open my lectures." Melun, a town ten leagues from Paris, where the court frequently resided, was the place which he chose for this bold display of his talents. But it was not without considerable difficulty that Abelard executed his plan; for De Champeaux, who regarded him as a rival, openly employed all his interest against him. Abelard at length prevailed, his school was opened, and his lectures were attended by crowded and admiring auditories. Emboldened by this success, and perhaps stimulated by unworthy resentment, Abelard resolved to maintain an open contest with his master, and for this purpose removed his school to Corbeil near Paris. The disputants frequently met in each other's schools; and the contest was supported on each side with great spirit, amidst crowds of their respective scholars. The young champion was in the end victorious, and his antagonist was obliged to retire.

Constant application and violent exertions had now so far impaired Abelard's health, that it was become necessary for him to interrupt his labours; and, with the advice of his physician, he withdrew to his native country. Two years afterwards, he returned to Corbeil, and found that De Champeaux had taken the monastic habit among the regular canons in the convent

of St Victor; but that he still continued to teach rhetoric and logic, and to hold public disputations in theology. Returning to the charge, he renewed the contest, and his opponent was obliged to acknowledge himself defeated; and the scholars of De Champeaux deserted him, and went over in crowds to Abelard. Even the new professor, who had taken the former school of De Champeaux, voluntarily surrendered the chair to the young philosopher, and requested to be enrolled among his disciples. A triumph so complete, while it gratified the vanity of Abelard, could not fail to provoke the resentment of his old master, who had influence to obtain the appointment of a new professor, and drive Abelard back to Melun. De Champeaux's motive for this violent proceeding was soon perceived; even his friends were ashamed of his conduct; and he retired from the convent into the country. When Abelard was informed of the flight of his adversary, he returned towards Paris, and took a new station at the abbey on Mount St Genevieve. His rival, the new professor, was unequal to the contest, and was soon deserted by his pupils, who flocked to the lectures of Abelard. De Champeaux too returning to his monastery, renewed the struggle; but so unsuccessfully, that Abelard was again victorious.

During a short absence, in which Abelard visited his native place, De Champeaux was preferred to the see of Chalons. The long and singular contest between these philosophers terminated; and Abelard, perhaps for want of a rival to stimulate his exertions, or possibly through envy of the good fortune of his rival, determined to exchange the study and profession of philosophy for that of theology. He therefore quitted his school at St Genevieve, and removed to Laon, to become a scholar of Anselm. From this celebrated master he entertained high expectations; but they were soon disappointed. On attending his lectures, he found that, though he possessed uncommon fluency of language, he left his auditors without instruction. "You would have thought," says Abelard, "he was kindling a fire, when instantly the whole house was filled with smoke, in which not a single spark was visible: he was a tree covered with a thick foliage, which pleased the distant eye; but on a nearer inspection, there was no fruit to be found: I went up to this tree in full expectation, but I saw that it was the fig-tree which the Lord had cursed." (*Hist. Calamit.*). Abelard gradually retired from these unprofitable lectures, but without offering offence either to the veteran professor, or his scholars. In conversation one of them asked him, what he thought of the study of the Scriptures? Abelard replied, that he thought the explanation of them a task of no great difficulty; and, to prove his assertion, he undertook to give a comment, the next day, upon any part of the Scriptures they should mention. They fixed upon the beginning of the prophecy of Ezekiel; and the next morning he explained the passage in a theological lecture, which was heard with admiration. For several successive days, the lectures were at the request of the audience continued; the whole town pressed to hear them; and the name of Abelard was echoed through the streets of Laon. Anselm, jealous of the rising fame of this young theologian, prohibited his lectures, under the pretence that so young a lecturer might fall into mistakes, which would

Abelard.

Abelard. would bring discredit upon his master. Abelard, whose ambition required a wider field than that of Laon, obeyed the prohibition, and withdrew. He returned to Paris, whither the fame of his theological talents had arrived before him, and opened his school with his lectures on the prophecy of Ezekiel. His auditors were delighted; his school was crowded with scholars; and he united in his lectures the sciences of theology and philosophy with so much success, that multitudes repaired to his school from various parts of France, from Spain, Italy, Germany, Flanders, and Great Britain.

Hitherto Abelard has appeared with high distinction, as an able disputant, and a popular preceptor: we must now view him under a different character, and, when nearly arrived at the sober age of forty, see him, on a sudden, exchanging the school of philosophy for the bower of pleasure, and even disgracing himself, as will too plainly appear in the sequel, by forming and executing a deliberate plan for the seduction of female innocence. It happened that there was at this time, resident in Paris, Heloise, the niece of Fulbert, one of the canons of the cathedral church, a lady about eighteen years of age, of great personal beauty, and highly celebrated for her literary attainments. Abelard, whose vanity had been satiated with fame, and the vigour of whose mind was now enervated by repose, found himself inclined to listen to the voice of passion. He beheld with ardent admiration the lovely Heloise, and confident that his personal attractions were still irresistible, he determined to captivate her affections. Fulbert, who doubtless thought himself honoured by the visits of so eminent a scholar and philosopher, received him into his house as a learned friend. He was soon afterwards prevailed upon, by a handsome payment which Abelard offered for his board, to admit him into his family; and, apprehending no hazard from a man of Abelard's age and profession, confidentially requested him to undertake the instruction of Heloise. Abelard accepted the trust, but, as it seems, without any other intention than to betray it. The hours of instruction were employed in other lessons than those of learning and philosophy; and to such a master as Abelard, it was not surprising that Heloise was an apt scholar. Fulbert's respectful opinion of the philosopher, and his partiality for his niece, long concealed from him an amour, which was become the subject of general conversation. At length the discovery burst upon him like a clap of thunder. Upon discovering her pregnancy, it was thought necessary for her to quit her uncle's house, and Abelard conveyed her to Bretagne, where his sister was prepared to receive them. Here Heloise was delivered of a son, to whom they gave the whimsical name of Astrolabus. Abelard, upon the birth of the child, proposed to Fulbert to marry his niece, provided the marriage might be kept secret: Fulbert consented, and Abelard returned to Bretagne to fulfil his engagement. Heloise, partly out of regard to the honour of Abelard, whose profession bound him to celibacy, and partly from a romantic notion that love like hers ought not to submit to ordinary restraints, at first gave Abelard a peremptory refusal. He, however, at last prevailed, and they were privately married at Paris. Heloise from this time met with severe treatment from

her uncle, which furnished Abelard with a plea for removing her from his house, and placing her in the abbey of Benedictine nuns, in which she had been educated. Fulbert concluded, perhaps not without reason, that Abelard had taken this step, in order to rid himself of an incumbrance which obstructed his future prospects. Deep resentment took possession of his soul, and he meditated revenge. He employed several ruffians to enter his chamber by night, and inflict upon his person a disgraceful and cruel mutilation. The deed was perpetrated; the ruffians were taken, and suffered, according to the *Lex Talionis*, the punishment they had inflicted; and Fulbert, for his savage revenge, was deprived of his benefice, and his goods were confiscated. Unable to support his mortifying reflections, Abelard resolved to retire to a convent. At the same time he formed the selfish resolution, that, since Heloise could no longer be his, she should never be another's, and ungenerously demanded from her a promise to devote herself to religion; and even insisted upon her taking the holy vow before him, suspecting, as it seems, that if he first engaged himself, she might violate her promise, and return to the world; a circumstance, with which she afterwards thus tenderly reproached him: "In that one instance, I confess, your mistrust of me tore my heart; Abelard, I blushed for you." Heloise submitted to the harsh injunction, professed herself in the abbey of Argenteuil, and receiving the religious habit, exclaimed in the words of Cornelia:

O maxime conjux!

*O thalamis indigne meis! hoc juris habebat
In tantum fortuna caput? cur impia nupsi,
Si miserum factura fui? nunc accipe penas,
Sed quas sponte luam.*

LUCAN.

"Ah! my once greatest lord! Ah! cruel hour!
Is thy victorious head in Fortune's power!
Since miseries my baneful love pursue;
Why did I wed thee, only to undo!
But see, to death my willing neck I bow;
Atone the angry gods by one kind blow." ROWZ.

A few days after Heloise had taken her vows, Abelard assumed the monastic habit in the abbey of St Denys, determined as it seems to forget, in hope of being forgotten by the world. However, his admirers and scholars in Paris were unwilling that the world should lose the benefit of his labours, and sent deputies to entreat him to return to his school. After some deliberation, he again yielded to the call of ambition; and at a small village in the country, he resumed his lectures, and soon found himself surrounded with a numerous train of scholars. The revival of his popularity renewed the jealousy of other professors, who took the first opportunity of bringing him under ecclesiastical censure. A treatise which he published at this time, entitled, "The Theology of Abelard," was supposed to contain some heretical tenets. A synod was called at Soissons in the year 1121; the work was condemned to be burnt, and Abelard was commanded to throw it into the flames. After being involved in other controversies, new charges were brought against him, and he fled to the convent of St Ayoul at Provins in Champagne, the prior of which was his intimate friend. The place of his retreat was soon discovered, and threats

Abelard. threats and persuasions were in vain employed to recal him : at last he obtained permission to retire to some solitary retreat, on condition that he should never again become a member of a convent.

The spot which he chose was a vale in the forest of Champagne, near Nogent upon the Seine. Here Abelard, in 1122, erected a small oratory, which he dedicated to the Trinity, and which he afterwards enlarged, and consecrated to the Third Person, the Comforter, or Paraclete. Here he was soon discovered, and followed by a train of scholars. A rustic college arose in the forest, and the number of his pupils soon increased to six hundred. Jealousy again provoked the exertions of his enemies, and he was meditating his escape, when, through the interest of the duke of Bretagne, and with the consent of the abbot of St Denys, he was elected superior of the monastery of St Gildas, in the diocese of Vannes, where, though not without frequent and grievous vexations, he remained several years.

About this time, Suger the abbot of St Denys, on the plea of an ancient right, obtained a grant for annexing the convent of Argenteuil, of which Heloise was now prioress, to St Denys, and the nuns, who were accused of irregular practices, were dispersed. Abelard, informed of the distressed situation of Heloise, invited her, with her companions, eight in number, to take possession of the Paraclete.

It was during Abelard's residence at St Gildas, that the interesting correspondence passed between him and Heloise, which is still extant. The letters of Heloise, in this correspondence, abound with proofs of genius, learning, and taste, which might have graced a better age. It is upon these letters that Mr Pope has formed his "Epistle from Eloisa to Abelard;" a piece which is entitled to the highest praise for its poetical merit, but which deviates in many particulars from the genuine character and story of Heloise, and culpably violates moral propriety. Here, too, Abelard probably wrote his "Theology," which again subjected him to persecution. His opinions were pronounced heretical by a council; and although he appealed to Rome, the judgment of the council was confirmed by the pope; and he was sentenced, unheard, to perpetual silence and imprisonment. By the interposition of some friends, however, and by a submissive apology, he obtained his pardon, with permission to end his days in the monastery of Cluni.

At Cluni he was retired, studious, and devout. The monks of the convent importuned him to resume the business of instruction. In a few occasional efforts he complied with their solicitation; and his lectures were heard with undiminished applause. But his health and spirits were much enfeebled, and gradually declined till he died in the 63d year of his age, A. D. 1142. His body was sent to Heloise to be interred in the convent of the Paraclete. Heloise survived her husband 21 years, a pattern of conjugal affection and monastic virtue; and was buried in the same grave, as appears by the following epitaph:

*Hic
Sub eodem marmore, jacent
Hujus Monasterii
Conditor, Petrus Abelardus,*

*Et abbatissa prima, Heloisa,
Olim studiis, ingenio, infaustis nuptiis
Et pœnitentia,
Nunc æterna, ut speramus, felicitate,
Conjuncti.*

*Petrus obiit 21 Aprilis 1142.
Heloisa 17 Maii 1163.*

The amour, which has given Abelard so much celebrity, will remain an eternal blot upon his memory. It was not a juvenile indiscretion of which Abelard was guilty, but according to his own confession, the seduction of innocence, deliberately planned, and resolutely executed. It was accompanied with breach of confidence, violation of duty, and degradation of character. Except in the grant of the Paraclete as an asylum to Heloise and her sisterhood, an uniform selfishness appears in Abelard's conduct. In Heloise, the criminality, though not obliterated, was palliated by youthful ardour and inexperience; and extreme sensibility, romantic attachment, noble generosity, and disinterested invincible constancy, united to throw a veil over human frailty. Considered apart from this disgraceful affair, Abelard appears with more advantage. His writings, indeed, will not give the reader a high idea of his genius or taste: but it cannot be questioned, that the man who could foil the first masters of the age at the weapons of logic, could draw round him crowded and admiring auditors, and could collect scholars from different provinces and countries wherever he chose to form a school, must have possessed extraordinary talents. Had his love of truth been equal to his thirst of fame, and had his courage in adhering to his principles been equal to his ingenuity in defending them, his sufferings and persecutions might have excited more regret, and his title to honourable remembrance would have been better established. Upon the whole, of Abelard it may perhaps with truth be said, that he was too vain to be truly great, and too selfish to be eminently good, and that his character is rather adapted to excite admiration than to command respect.

His principal works, written in Latin, are, "An Address to the Paraclete on the Study of the Scriptures; Problems and Solutions; Sermons on the Festivals; A Treatise against Heresies; An Exposition of the Lord's Prayer; A Commentary on the Romans; A System of Theology; and his Letters to Heloise and to others." (*Gen. Bieg.*).

ABEL TREE, or ABELE TREE, an obsolete name for a species of the poplar. See *POPULUS*, *BOTANY Index*.

ABELIANS, ABOLITES, or ABELONIANS, in church history, a sect of heretics mentioned by St Austin, which arose in the diocese of Hippo in Africa, and is supposed to have begun in the reign of Arcadius, and ended in that of Theodosius. Indeed it was not calculated for being of any long continuance. Those of this sect regulated marriage after the example of Abel; who, they pretended, was married, but died without ever having known his wife. They therefore allowed each man to marry one woman, but enjoined them to live in continence; and, to keep up the sect, when a man and woman entered into this society, they adopted a boy and a girl, who were to inherit their goods, and to marry upon the same terms of not begetting

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getting children, but of adopting two of different sexes.

ABELLA, anciently a town of Campania, near the river Clanus. The inhabitants were called Abellani, and said to have been a colony of Chalcidians. The nux Avellana, called also *Prænestina*, or the *hazel nut*, takes its name from this town, according to Macrobius. Now *Avella*.

ABELLINUM, anciently a town of the Hirpini, a people of Apulia; distant about a mile from the rivulet Sabatto, between Beneventum and Salernum. Pliny calls the inhabitants *Abellinates*, with the epithet *Protopi*, to distinguish them from the Abellinates Marsi. Now *Avellino*. E. Long. 15. 20. N. Lat. 21. 0.

ABEN EZRA, **ABRAHAM**, a celebrated rabbi, born at Toledo in Spain, called by the Jews, The wise, great, and admirable Doctor, was a very able interpreter of the Holy Scriptures; and was well skilled in grammar, poetry, philosophy, astronomy, and medicine. He was also a perfect master of the Arabic. His principal work is, "Commentaries on the Old Testament," which is much esteemed: these are printed in Bomberg's and Buxtorf's Hebrew Bibles. His style is clear, elegant, concise, and much like that of the Holy Scriptures: he almost always adheres to the literal sense, and everywhere gives proofs of his genius and good sense; he, however, advances some erroneous sentiments. The scarcest of all his books is entitled "Jesud Mora;" which is a theological work, intended as an exhortation to the study of the Talmud. He also wrote *Elegantiae Grammaticæ*, printed in octavo at Venice in 1548. He died in 1174, aged 75.

ABEN MELLER, a learned rabbin, who wrote a commentary on the Old Testament in Hebrew, entitled, "The Perfection of Beauty." This rabbin generally follows the grammatical sense and the opinions of Kimchi. The best edition is that of Holland.

ABENAS, a town of France, in the department of Ardesche; and upon a river of the same name, at the foot of the Cevennes. E. Long. 4. 20. N. Lat. 44. 37.

ABENEL GAUBY, a fixed star of the second or third magnitude, in the south scale of the constellation **LIBRA**.

ABENSPERG, a small town of Germany, in the kingdom of Bavaria, and in the government of Munich. It is seated on the river Abentz, near the Danube. E. Long. 11. 38. N. Lat. 48. 45.

ABERAVON, a borough town of Glamorganshire in Wales, governed by a portreeve. It had a market, which is now discontinued. The vicarage is discharged, and is worth 45l. clear yearly value. It is seated at the mouth of the river Avon, 194 miles west of London. W. Long. 3. 35. N. Lat. 51. 40.

ABERBROTHICK, or **ARBROATH**, one of the royal boroughs of Scotland, situated in the county of Angus, about 40 miles N. N. E. of Edinburgh, in W. Long. 2. 29. and N. Lat. 56. 36. It is seated on the discharge of the little river Brothie into the sea, as the name imports, *Aber* in the British implying such a situation. It is a small but flourishing place, well built, and still increasing. The town has been in an improving state for the last forty years, and the number of inhabitants greatly augmented; which is owing to the introduction of manufactures. The population in 1801 was above 7000. The inhabitants

consist chiefly of weavers of coarse brown linens, and some sail-cloth; others are employed in making white and coloured threads: the remainder are either engaged in the shipping of the place, or in the necessary and common mechanic trades. The brown linens, or osnaburgs, were manufactured here before any encouragement was given by government, or the linen company erected at Edinburgh. It appears from the books of the stamp-office in this town, that seven or eight hundred thousand yards are annually made in the place, and a small district round. Besides this export and that of thread, much barley and some wheat is sent abroad. The foreign imports are flax, flax-seed, and timber, from the Baltic. The coasting trade consists of coals from Borrowstounness, and lime from Lord Elgin's kilns in Fife. At this place, in default of a natural harbour, a tolerable artificial one of piers has been formed, where, at spring tides, which rise here fifteen feet, ships of two hundred tons can come, and of eighty at neap tides; but they must lie dry at low water. This port is of great antiquity: there is an agreement yet extant between the abbot and the burghers of Aberbrothick, in 1194, concerning the making of the harbour. Both parties were bound to contribute their proportions; but the largest fell to the share of the former, for which he was to receive an annual tax payable out of every rood of land lying within the borough. The glory of this place was the abbey, whose very ruins give some idea of its former magnificence. It was founded by William the Lion in 1178, and dedicated to our celebrated primate Thomas à Becket. The founder was buried there; but there are no remains of his tomb, or any other, excepting that of a monk of the name of Alexander Nicol. The monks were of the Tyronensian order; and were first brought from Kelso, whose abbot declared those of this place, on the first institution, to be free from his jurisdiction. The last abbot was the famous Cardinal Beaton, at the same time archbishop of St Andrew's, and, before his death, as great and absolute here as Wolsey was in England. King John, the English monarch, granted this monastery most uncommon privileges; for, by charter under the great seal, he exempted it *à telonniis et consuetudine* in every part of England, except London. At Aberbrothick is a chalybeate water, similar to those of Peterhead and Glendye.

ABERCONWAY, or **CONWAY**, in Caernarvonshire, North Wales; so called from its situation at the mouth of the river Conway. It is a handsome town, pleasantly situated on the side of a hill, and has many conveniencies for trade; notwithstanding which it is the poorest town in the county. It was built by Edward I. and had not only walls, but a strong castle, which is now in ruins. Here is an inscription on the tomb of one Nicholas Hooks, importing that he was the one-and-fortieth child of his father, and had twenty-seven children himself. It is 229 miles from London. W. Long. 3. 47. N. Lat. 53. 20.

ABERCROMBY, **THE HONOURABLE ALEXANDER** (Lord Abercromby), a judge in the courts of session and justiciary in Scotland, was the youngest son of George Abercromby, of Tullibody, Esq. of a respectable family in Clackmannanshire, and was born on the 15th October 1745. Mr Abercromby was early destined for the profession of the law, and with this

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view he was educated at the university of Edinburgh, where he passed through the requisite course of languages, philosophy, and law, and was admitted advocate in the year 1766: but neither during the time of his education, or for some years after he entered his professional career, did he give much promise of those eminent abilities and that assiduous application which afterwards distinguished him as a pleader and a judge. The vivacity of his disposition, and the sprightliness of his manners, led him to prefer the gayer amusements of life, and the society of men of fashion and pleasure, to the arduous prosecution of philosophical studies, and to the less inviting and more barren paths of legal disquisitions. When, however, either during his academical course, or the first years of his practice at the bar, occasions required the exertion of his talents, the quickness of his perception, and the acuteness and strength of his understanding, enabled him to display such powers of attention and application to business as are seldom acquired but by regular and uniform habits of industry, and by the force of constant application. But, to attain that distinction and eminence to which he aspired, and to secure that independence which the patrimony of a younger son of a family, more respectable than opulent, could not afford him, he found it necessary to withdraw from those scenes of amusement and pleasure, and to seclude himself from that society which his gaiety and agreeable manners had enlivened and entertained, and to think seriously of applying to the labours of his profession. With much credit to himself, and with undiminished vigour of mind, he threw off the character of the man of fashion, and devoting his time and talents to the toilsome detail of business as a lawyer, by his successful efforts he soon gave solid proofs of the distinguished abilities which he possessed. About this time, he was engaged as counsel in a cause in which public curiosity and opinion were much interested and divided. This cause, which was of a very intricate nature, afforded an opportunity of making a more eminent display of his professional talents. By a speech which he delivered on this occasion, conspicuous for accurate discrimination, strength of argument, and impressive eloquence, he gave a favourable presage of his future celebrity. The marks of approbation which he now received probably taught him to appreciate those talents which had hitherto remained concealed or unemployed, and encouraged him to call them forth into exertion.

In 1780, Mr Abercromby resigned the office of sheriff depute of Stirlingshire, which he had held for several years, and accepted of that of depute-advocate, with the hope of extending his employment in the line of his profession. In this step he was not disappointed; for his reputation and business rapidly increased, and soon raised him to the first rank of lawyers at the Scotch bar. In the midst of the laborious duties of his profession, Mr Abercromby did not entirely preclude himself from indulging in the elegant amusements of polite literature. He was one of that society who set on foot two periodical papers, the *Mirror* and *Lounger*, published at Edinburgh; the former in 1779, and the latter in 1785. To the *Mirror* he contributed ten papers, and to the *Lounger* nine. The names of the authors have been published in the late

editions of these works, which renders it unnecessary to point out those papers of which Mr Abercromby was the author.

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In May 1792, he was appointed one of the judges of the court of session, and in December following he was called to a seat in the court of judicature. Lord Abercromby continued to discharge the arduous duties of these important offices till summer 1795, when he was seized with a pectoral complaint, of which he died on the 17th November the same year, at Exmouth in Devonshire, where he had gone for the recovery of his health.

As a lawyer, Lord Abercromby had acquired great reputation. His papers on law-cases were distinguished for precision and perspicuity. His speeches were elegant, animated, and eloquent. With the most pathetic feeling he pled the cause of the unfortunate; while he could assume the severe tone of virtuous indignation in rebuking injustice and oppression. With such qualifications, added to the strictest attention and punctuality, he could not fail to become an able and respectable judge. In this high station, his deportment was grave, dignified, and decided. His elocution was solemn and deliberate; and his opinions, delivered in this manner, had an impressive effect. Avoiding a detail of circumstances, and never arguing the cause as a lawyer, he pronounced with brevity and precision the opinion of a judge drawn from its striking and prominent features. His only writings are the papers in the periodical publications already alluded to. They are marked by an easy turn of expression, manly and virtuous sentiments, and, when the subject required it, by delicate irony or unaffected tenderness. (*Phil. Trans. Edin.*).

ABERCROMBY, Sir Ralph, knight of the Bath, and a lieutenant-general in the British army, an elder brother of the preceding, was born in the year 1738. Being destined for the army, he obtained, in May 1756, a cornet's commission in the 2d dragoon guards; and rose, April 24. 1762, to the rank of a captain in the 3d regiment of horse. Ascending through the intermediate gradations of rank, he was appointed, November 3. 1781, to the colonelcy of the 103d infantry. September 28. 1787, he was promoted to the rank of major-general. November 5. 1795, he obtained the command of the 7th regiment of dragoons. Having been nearly 40 years in the army, having served with honour in two wars, and being esteemed one of the ablest, coolest, and most intrepid officers in the whole British forces, he was employed on the continent under his royal highness the duke of York, in the commencement of the present war. In the action on the heights of Cateau, he commanded the advanced guard; and was wounded at Nimeguen. He conducted the march of the guards from Deventer to Oldensaal, in the retreat of the British out of Holland, in the winter of 1794-5. In August 1795, he was appointed to succeed Sir Charles Grey, as commander in chief of the British forces in the West Indies. March 24, 1796, Grenada was suddenly attacked and taken by a detachment of the army under his orders. He afterwards obtained possession of the settlements of Demarara and Issequibo, in South America. St Lucia was next taken by more difficult exertions, in which the ability of this eminent commander was signally displayed.

Abercromby. played. St Vincent's was, by the middle of June, added to the British conquests. Trinidad, in February 1797, shared the same fate. He returned the same year to Europe, and, in reward for such important services, was invested with the red ribbon, appointed to the command of the regiment of Scots Greys, entrusted with the governments of the Isle of Wight, Fort George, and Fort Augustus, and raised to the high military rank of lieutenant-general. He held, for a time, the chief command of the forces in Ireland. In that command, he laboured to maintain the discipline of the army, to suppress the rising rebellion, and to protect the people from military oppression, with a care worthy alike of the great general and the enlightened and beneficent statesman. From that station he was called to the chief command of the forces in Scotland. His conduct in this distinguished appointment gave universal satisfaction. When the great enterprise against Holland was resolved upon, Sir Ralph Abercromby was called again to command, under his royal highness the duke of York. The difficulties of the ground, the inclemency of the season, delays, though inconvenient, yet unavoidable, the disorderly movements of the Russians, and the timid duplicity of the Dutch, disappointed our hopes of that expedition. But, by the Dutch, the French, the British, it was confessed, that even victory, the most decisive, could not have more conspicuously proved the talents of this illustrious officer. His country applauded the choice, when he was sent with an army to dispossess the French of Egypt. His experience in Holland and Flanders, and in the climate of the West Indies particularly, fitted him for this new command. He accomplished some of the first duties of a general, in carrying his army in health, in spirits, and with the requisite intelligence and supplies, to the destined scene of action. The landing, the first dispositions, the attacks, and the courage opposed to attack, the spirit with which his army appears to have been by confidence in their leader inspired, the extraordinary superiority which the British infantry under his command evinced to that which was thought the bravest and best disciplined infantry in the world, demonstrate that all the best qualities of the greatest commanders were in Sir Ralph Abercromby united—that they were all summoned forth into activity in the glorious achievements amid which he fell.—In his private character he was modest, disinterested, benevolent, and honourable. General Lord Hutchinson, who succeeded him in the command, in the dispatches with the account of his death, has given a fine eulogium on his character as a soldier, and strongly expressive of the high estimation in which he was held by the army.—“We have sustained an irreparable loss in the person of our never sufficiently to be lamented commander in chief, Sir Ralph Abercromby, who was mortally wounded in the action, and died on the 28th of March. I believe he was wounded early, but he concealed his situation from those about him, and continued in the field, giving his orders with that coolness and perspicuity which had ever marked his character, till long after the action was over, when he fainted through weakness and loss of blood. Were it permitted for a soldier to regret any one who has fallen in the service of his country, I might be excused for lamenting him more than any

other person; but it is some consolation to those who tenderly loved him, that, as his life was honourable, so was his death glorious. His memory will be recorded in the annals of his country—will be sacred to every British soldier—and embalmed in the recollection of a grateful posterity.” His remains were conveyed on board Admiral Lord Keith's flag ship to Malta, attended by Colonel Sir John Dyer, and were interred in the commandery of the grand master, with the highest military honours.

A monument to his memory, to be erected in St Paul's church, London, at the public expence, was voted by the house of commons. His widow has been created a peeress, and a pension of 2000*l.* a-year for her and three lives settled on the family. (*Gent. Mag.*).

ABERDEEN, the name of two cities in Scotland, called the *Old* and *New Town*, situated on the German ocean, in W. Long. 2. 8. and N. Lat. 57. 8.

ABERDEEN, *Old*, is a place of great antiquity. According to tradition, it was of note in the reign of Gregory, who conferred on it some privileges about the year 893. In 1004, Malcolm II. founded a bishopric at a place called Mortlich in Banffshire, in memory of a signal victory which he there gained over the Danes; which bishopric was translated to Old Aberdeen by David I.; and in 1163, the then bishop of Aberdeen obtained a new charter from Malcolm IV. There is extant a charter of Alexander II. by which, in 1217, the king grants to Aberdeen the same privileges he had granted to his town of Perth.

The *Old Town* lies about a mile to the north of the *New*, at the mouth of the river Don, over which is a fine Gothic bridge, of a single arch, greatly admired, which rests on a rock on each side. This arch, said to have been built by a bishop of Aberdeen about the year 1290, is 67 feet wide at the bottom, and 34½ feet high above the surface of the river, which at ebb tide is here 19 feet deep. The *Old Town* was formerly the seat of the bishop, and had a large cathedral commonly called *St Machar's*. Two very antique spires, and one aisle, which is used as a church, are now the only remains of it. The bishopric was founded in the time of David I. as above mentioned. The cathedral had anciently two rows of stone pillars across the church, and three turrets; the steeple, which was the largest of these turrets, rested upon an arch, supported by four pillars. In this cathedral there was a fine library; but about the year 1560, it was almost totally destroyed. But the capital building is the King's College on the south side of the town, which is a large and stately fabric. It is built in form of a square, with cloisters on the south side. The chapel is very ruinous within; but there still remains some wood work of exquisite workmanship. This was preserved by the spirit of the principal at the time of the Reformation, who armed his people and checked the blind zeal of the barons of the Mearns; who, after stripping the cathedral of its roof, and robbing it of the bells, were going to violate this seat of learning. They shipped their sacrilegious booty, with an intention of exposing it to sale in Holland: but the vessel had scarcely gone out of port, when it perished in a storm with all its ill-gained loading. The steeple is vaulted with a double cross arch; above which is an imperial crown, supported by eight stone pillars, and closed with a globe and two gilded

Aberdeen. crosses. In the year 1631 this steeple was thrown down by a storm, but was soon after rebuilt in a more stately form. This college was founded in 1494, by William Elphinston bishop of this place, lord chancellor of Scotland in the reign of James III. and lord privy seal in that of James IV. But James IV. claimed the patronage of it, and it has since been called the *King's College*. The number of students in 1816-17 was 187. This college, and the Marischal College in the New Town, form one university, called the *University of King Charles*. The library is large, but not remarkable for many curiosities. Hector Boethius was the first principal of the college; and sent for from Paris for that purpose, on an annual salary of forty marks Scots, at thirteen pence each. The square tower on the side of the college was built by contributions from General Monk and the officers under him then quartered at Aberdeen, for the reception of students; of which about a hundred attend the college, many of whom lodge in it.

ABERDEEN, New, is the capital of the shire of Aberdeen. For extent, trade, and beauty, it greatly exceeds any town in the north of Scotland. It is built on a hill or rising ground, and lies on a small bay formed by the Dee, deep enough for a ship of 200 tons, and above two miles in circumference.—The buildings (which are of granite from the neighbouring quarries) are generally four stories high; and have for the most part, gardens behind them, which give it a beautiful appearance. On the high street is a large church which formerly belonged to the Franciscans. This church was begun by Bishop William Elphinston; and finished by Gavin Dunbar, bishop of Aberdeen, about the 1500. Bishop Dunbar is said likewise to have built the bridge over the Dee, which consists of seven arches. In the middle of Castle street is an octagon building, with neat bas relieves of the kings of Scotland from James I. to James VII. The town-house makes a good figure, and has a handsome spire in the centre. The grammar school is a low but neat building. Gordon's hospital is handsome; in front is a good statue of the founder: it maintains forty boys, who are apprenticed at proper ages. The infirmary is a large plain building, and sends out between eight and nine hundred cured patients annually. But the chief public building in the New Town is the Marischal College, founded by George Keith earl Marischal, in the year 1593; but since greatly augmented with additional buildings. In both the Marischal and King's college the languages, mathematics, natural philosophy, divinity, &c. are taught. The number of students in the session of 1816-17 was 212, besides 105 students of divinity, alternately attending each university. The convents in Aberdeen were, one of Mathurines or of the order of the Trinity, founded by William the Lion, who died in 1214; another of Dominicans, by Alexander II.; a third of Observantines, a building of great length in the middle of the city, founded by the citizens and Mr Richard Vans, &c.; and a fourth of Carmelites, or White Friars, founded by Philip de Arbuthnot in 1540.

Aberdeen, including the Old Town, is supposed to contain 25,000 inhabitants. Its trade is considerable, but might be greatly extended by an attention to the white fisheries.

The harbour was long a great detriment to its trade, and occasioned the loss of many lives and much property. A stranger could never depend upon finding it as he left it; while vessels lay at anchor in the road till the tide should make, they have often been wrecked by storms which suddenly arose. It was very narrow at the mouth, having the easterly rocky point of the Grampian mountains on the south, and a flat blowing sand on the north, extending along the coast for many miles. By the easterly and north-east storms the sand was driven in a long ridge across the harbour's mouth, and formed what was called the *bar*. Upon this bar the depth of water at low tide was sometimes not above three feet. Clearing away the sand, though but a partial and temporary remedy, was a matter of great expence to the community. If it was cleared one week so as to have five or six feet of water at ebb, a fresh storm the next week undid all that had been done. The town at last came to the resolution of erecting a strong pier on the north side of the harbour. This pier is 1200 feet in length, and gradually increases in thickness and height as it approaches to the sea, where the head or rounding is 60 feet diameter at the base, and the perpendicular elevation is 38 feet. The whole is built of granite, which is a very durable stone: many of the outside stones are above three tons weight, with hewn beds. It was built under the direction of Mr Smeaton; and other extensive improvements have since been executed, the whole of which have cost about 120,000*l*. About 150 vessels belong to the port of Aberdeen, whose aggregate burden amounts to 17,131 tons. The principal exports are grain, fish, thread, hosiery, cotton and linen goods.

Aberdeen, like most of the other royal burghs of Scotland, has long been encumbered by its debts. In 1789, the town debt was something less than 12,000*l*. but from various causes it had increased so rapidly since that period, that in 1819 it amounted to 232,745*l*. 10*s*. The whole of the town revenues being insufficient to discharge the interest of this debt, the treasurer was under the necessity in February 1817 of declaring the burgh insolvent; and in consequence of this step all the burgh property, feu-duties, and funds, were made over to trustees. The magistrates then in office, in an address to their successors, published 19th September 1817, ascribed the embarrassed state of the burgh chiefly to the secrecy and concealment fostered by the system of self-election, and to the want of some control on the part of the citizens over the town's affairs. The election that followed not having been regularly conducted, was challenged by the burghesses, and set aside by the Court of Session. It was now expected that the magistracy would be restored by a poll election—the mode sanctioned by precedent in such cases; but the Privy Council issued a warrant in August 1818, directing the persons who had been in office previous to the irregular election, to meet and elect a new set of magistrates. This proceeding excited great dissatisfaction, not only because it appeared to be an infringement on the rights of the burghesses, but because it recalled those very men to office by whose mismanagement the affairs of the city had been brought to a state of insolvency, and most of whom had denounced the system as pernicious. The committee of the House of Commons which sat in 1819 on the subject of burgh reform,

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reform, reported on the case of Aberdeen. From this report, it appears that the town lands, which were formerly very extensive, had been alienated, with the reservation of very inadequate feu-duties. The fishings of the Dee and Don, now producing about 10,000*l.* a-year, were alienated for an annual feu-duty of 27*l.* 7*s.* 3*d.* The lands belonging to charitable establishments, of which the magistrates were only trustees, had been sold, and the proceeds applied to the city expenditure. The amount due to the various charities when the town became insolvent was about 80,000*l.* for which the charities receive only four per cent. The sum of 127,000*l.* had been borrowed under an act of Parliament, for building wet and graving docks, but the works were never executed. These, and other large sums borrowed by the magistrates, appear to have been dissipated in some ill-conducted plans of local improvement, which have made very trifling returns; and not only the citizens were ignorant of the burdens which were thus accumulating over their property, but very few of the magistrates themselves seem to have fully understood the state of the town's affairs. A statement, purporting to be an abstract of the town's affairs, was annually exhibited to the burghesses at Michaelmas; but this appears rather to have been for the purpose of deception than information; for, in 1810, when the town actually owed upwards of 140,000*l.* the *whole* debt, according to the statement shewn to the burghesses, was only 6874*l.* 17*s.* 4*d.* The facts brought to light by the insolvency of Aberdeen, have roused the burghesses of most of the large burghs in Scotland to attempt some reform in the municipal government. Whether they shall succeed, may depend on circumstances; but it cannot be doubted that the existing system has a great tendency to encourage a wasteful expenditure, to repress public spirit, and to create jealousies between the magistrates and those whose welfare it should be their study to promote.

From a round hill, at the west end of the city, flow two springs, one of pure water, and the other of a quality resembling the German Spa. The population of Aberdeen in 1811 was 21,639. Aberdeen, with Aberbrothick, Brechin, Montrose, and Inverbervy, returns one member to parliament.

ABERDEENSHIRE, an extensive county in Scotland, is bounded on the north and east by the German ocean; on the south by the counties of Kincardine, Angus, and Perth; and on the west by Banff, Murray, and Inverness shires. It extends in length about 85 miles, from south-west to north-east, and about 40 in breadth, from the mouth of the river Dee to where it is bounded by the shire of Banff. Its extent in square miles may be estimated at 1986. It comprehends the districts of Marr, Garioch, Aberdeen Proper, and great part of Buchan. The district of Marr, which may be considered as the centre of Scotland, is wild, rugged, and mountainous; some of the hills rising with precipitous sides, to the height of 2000 feet above the level of the sea. The sides of the hills are covered with extensive natural forests; in many places impenetrable to human footsteps. Buchan is less hilly; but very barren, bleak and inhospitable to the view. The rest of the country is more fertile, having a gradual descent from the central district eastward to the sea. The coast is in general very bold and rocky.

The Boilers or Bullers of Buchan, arrest the attention of all strangers, by their stupendous craggy precipices. The soil, in so extensive a district, is as various as can be well supposed. The state of agriculture in the interior parishes of the county is very rude; but the example of many patriotic proprietors is producing wonders even in the most barren soils. Prejudices in husbandry, when deeply rooted, are with difficulty overcome; but even these are yielding to a more regular and modern system. A navigable canal, extending 18 miles, from the harbour of Aberdeen to Inverury, was opened in 1807. It is 23 feet wide, by 3 feet 9 inches deep; and is raised to the height of 168 feet above low water mark by 17 locks. The principal rivers of Aberdeenshire are, the Dee and Don, the Ythan, the Ugie, and the Cruden. The Deveron also forms its boundary with Banffshire for many miles. All the rivers have been long celebrated for the excellence of the salmon with which they abound. The rents of the fishings are estimated at 2480*l.* per annum, and the produce at upwards of 10,000*l.* Besides the fishings of the rivers, the sea coast of Aberdeenshire abounds with all kinds of excellent fish; and a number of fishing vessels are fitted out from the sea ports of the county, particularly Peterhead and Fraserburgh. Under the article of fisheries, we may mention the celebrated pearl fishing in the river Ythan. In this river some pearls have been found, which sold singly so high as 2*l.* and 3*l.* With regard to mineralogy, little wealth of that description has hitherto been found in this county. The granite quarries are the most valuable articles. From those in the neighbourhood of Aberdeen, 12,000 tons and upwards are annually exported to London, the value of which may be estimated at about 8400*l.* There are several quarries in the parish of Aberdour, which yield excellent millstones. There is a quarry of blue slate wrought in the parish of Culsalmond, and a vein of manganese in the neighbourhood of Old Aberdeen. The county abounds with limestone; but, from the want of coal, it cannot be wrought to much advantage, except near a sea port. In Old Machar and Old Deer parishes, about 55,000 bolls of lime are annually burnt, valued at 2750*l.* Some kelp is made on the coast, the value of which must be considerable. Plumbago, amethysts, emeralds, agates, asbestos, talc, mica, schistus, and other curious minerals, are found in many parts of the county. The principal manufacture carried on in the county, is the knitting of stockings and hose, in which all the women, and most of the old men and boys, are employed the greater part of the year. The other manufactures are too trifling to deserve particular notice. Aberdeenshire contains three royal boroughs; ABERDEEN, KINTORE, and INVERURY: and several large and handsome towns; as Peterhead, Fraserburgh, Huntly, and Old Meldrum. It is divided into 85 parishes.

The following account of the population of Aberdeenshire, at two different periods, is taken from the *Statist. Hist. of Scotland*.

Parishes.	Population in 1755.	Population in 1790—98.
1 Aberdeen, Old, or Old Machar	4945	8107
Aberdeen, New, including Footdee or Fittie	10785	16120
Aberdour	1397	1306

Aberdeen-
shire.

Aberdeen-shire.	Parishes.	Population in 1755.	Population in 1790—98.	Parishes.	Population in 1755.	Population in 1790—98.	Aberdeen-shire Abernethy.
	Aboyne	1695	1050	Peterculter	755	1002	
5	Alford	990	663	Peterhead	2487	4100	
	Auchindore	839	590	Pitsligo	1224	1300	
	Auchterless	1264	1264	70 Premnay	448	450	
	Bellhelvie	1471	1318	Rathen	1527	1730	
	Birse	1126	1300	Rayne	1131	1173	
10	Bourty	525	456	Rhynie and Essey	836	681	
	Cabrach	960	700	Skene	1251	1233	
	Cairny	2690	2600	75 Slains	1286	1117	
	Chapel of Garioch	1351	1035	Strathdon	1750	1524	
	Clatt	559	425	Strichen	1158	1400	
15	Clunie	994	885	Tarland	1300	1050	
	Coldstone, Logie	1243	1132	Tarvas	2346	1690	
	Coul	751	766	80 Tillynessle	335	412	
	Crathie and Braemarr	2671	2251	Tough	570	560	
	Crimond	765	917	Towie	656	550	
20	Cruden	2549	2028	Turreff	1897	2029	
	Culsalmund	810	745	Tyrie	596	949	
	Cushnie, now annexed to Leochel			85 Udney	1322	1137	
	Daviot	975	950				
	Deer, New	2313	2800				
25	Deer, Old	2813	3267				
	Drumblade	1125	886				
	Drumoak	760	692				
	Dyce	383	352				
	Echt	1277	963				
30	Ellon	2523	1830				
	Fintray	905	851				
	Forbes	456	370				
	Forgue	1802	1778				
	Foveran	1981	1230				
35	Fraserburgh	1682	2060				
	Fyvie	2528	2194				
	Gartley	1328	1800				
	Glass	1093	776				
	Glenbucket	430	449				
40	Glenmuick, &c.	2270	2117				
	Huntly	1900	3600				
	Insch	995	900				
	Inverury	730	732				
	Keig	499	475				
45	Keith-hall	1111	838				
	Kemnay	643	611				
	Kildrummie	562	426				
	Kincardine O'Niel	1706	2075				
	King Edward	1352	1577				
50	Kinnellar	398	342				
	Kinnethmont	791	830				
	Kintore	973	812				
	Leochel, including Cushnie	1286	642				
	Leslie	319	418				
55	Logie Buchan	575	509				
	Longside	1979	1792				
	Lonmay	1674	1650				
	Lumphanan	682	621				
	Machar, New	1191	1030				
60	Meldrum, Old	1603	1490				
	Methlick	1385	1035				
	Midmarr	979	945				
	Monquhitter	997	1500				
	Monymusk	1005	1130				
65	Newhills	959	1181				
	Oyne	643	630				

Total, 116,836 122,921

Population in 1811 - 135,075
See ABERDEENSHIRE, SUPPLEMENT.

ABERDOUR, a small town in Fifeshire, Scotland, on the frith of Forth, about ten miles north-west of Edinburgh. In old times it belonged to the Viponts; in 1126 it was transferred to the Mortimers by marriage, and afterwards to the Douglasses. William, lord of Liddesdale, surnamed the *Flower of Chivalry*, in the reign of David II. by charter conveyed it to James Douglas, ancestor of the present noble owner the earl of Morton. The monks of Inchcolm had a grant for a burial place here from Allan de Mortimer, in the reign of Alexander III. The nuns, usually styled the *Poor Clares*, had a convent at this place.

ABERFORD, a market town in the west riding of Yorkshire, stands in a bottom; and is about a mile in length, and pretty well built. It is near a Roman road, which is raised very high, and not far from the river Cock; between which and the town there is the foundation of an old castle still visible. It is 181 miles north-by-west from London. W. Long. 2. 45. N. Lat. 55. 52.

ABERGAVENNY, a large, populous, and flourishing town in Monmouthshire, seated at the confluence of the rivers Usk and Gavenny. It has a fine bridge over the Usk, consisting of fifteen arches; and being a great thoroughfare from the west part of Wales to Bath, Bristol, Gloucester, and other places, is well furnished with accommodation for travellers. It is surrounded with a wall, and had once a castle. It carries on a considerable trade in flannels, which are brought hither for sale from the other parts of the county. It is 142 miles distant from London. W. Long. 3. N. Lat. 51. 47. Abergavenny appears to have been the *Gibbanium* of Antoninus, and the town of Usk his *Burrium*. Population 2815 in 1811.

ABERNETHY, JOHN, an eminent dissenting minister, was the son of Mr John Abernethy, a dissenting minister in Coleraine, and was born there on the 19th of October 1680. When about nine years of age he was separated from his parents, his father being obliged

Abernethy, liged to attend some public affairs in London; and his **Aberration** mother, to shelter herself from the mad fury of the Irish rebels, retiring to Derry, a relation who had him under his care, having no opportunity of conveying him to her, carried him to Scotland; and thus he escaped the hardships and dangers of the siege of Derry, in which Mrs Abernethy lost all her other children. He afterwards studied at the university of Glasgow, where he remained till he took the degree of master of arts; and, in 1708, he was chosen minister of a dissenting congregation at Antrim, in which situation he continued above 20 years. About the time of the Bangorian controversy (for which see **HOADLEY**), a dissension arose among his brethren in the ministry at Belfast, on the subject of subscription to the Westminster Confession of Faith. In this controversy he became a leader on the negative side, and incurred the censure of a general synod. The agitation of parties began to be also felt among the members of his congregation. Many of them deserted him; which induced him to accept of an invitation to settle in Dublin, where his preaching was much admired. Here he continued for ten years, respected and esteemed. But his labours were terminated by a sudden attack of the gout in the head, to which he had been subject; and he died in December 1740, in the 60th year of his age. His writings, as was his character, are distinguished for candour, liberality, and manly sentiment. He published a volume of sermons on the Divine Attributes; after his death a second volume was published by his friends; and these were succeeded by four other volumes on different subjects: all of which have been greatly admired.

ABERNETHY, a small town in Strathern, a district of Perthshire in Scotland, situated on the river Tay, a little above the mouth of the Erne. It is said to have been the seat of the Pictish kings; and was afterwards the see of an archbishop, which was afterwards transferred to St Andrew's. In the churchyard of Abernethy, there is a tower of singular construction. It is of a circular form, is 74 feet in height, and 48 feet in circumference. The tower at Brechin is the only one of a similar structure in Scotland. The researches of the antiquarian have hitherto failed in discovering the uses of these insulated buildings. It has been supposed that they are of Pictish origin, and that they were intended as places of confinement for religious devotees in performing penance, and hence they have been denominated towers of repentance. Population 1635 in 1811.

ABERRATION, in *Astronomy*, an apparent motion of the celestial bodies, produced by the progressive motion of light, and the earth's annual motion in her orbit.

This effect may be explained and familiarized by the motion of a line parallel to itself, much after the manner that the composition and resolution of forces are explained.

M. de Maupertuis, in his "Elements of Geography," gives a familiar and ingenious idea of the aberration, in this manner: "It is thus," says he, "concerning the direction in which a gun must be pointed to strike a bird in its flight: instead of pointing it straight to the bird, the fowler will point a little before it, in the path of its flight, and that so much the more as the

flight of the bird is more rapid, with respect to the flight of the shot." In this way of considering the matter, the flight of the bird represents the motion of the earth, and the flight of the shot represents the motion of the ray of light. **Aberration.**

Mr Clairaut too, in the *Mem. de l'Acad. des. Sciences* for the year 1746, illustrates this effect in a familiar way, by supposing drops of rain to fall rapidly and quickly after each other from a cloud, under which a person moves with a very narrow tube; in which case it is evident that the tube must have a certain inclination, in order that a drop which enters at the top, may fall freely through the axis of the tube, without touching the sides of it; which inclination must be more or less according to the velocity of the drops in respect to that of the tube; then the angle made by the direction of the tube and of the falling drops, is the aberration arising from the combination of those two motions.

This discovery, which is one of the brightest that have been made in the present age, we owe to the accuracy and ingenuity of the late Dr Bradley, astronomer royal; to which he was occasionally led by the result of some observations which he had made with a view to determine the annual parallax of the fixed stars, or that which arises from the motion of the earth in its annual orbit about the sun.

The annual motion of the earth about the sun had been much doubted, and warmly contested. The defenders of that motion, among other proofs of the reality of it, conceived the idea of adducing an incontestable one from the annual parallax of the fixed stars, if the stars should be within such a distance, or if instruments and observations could be made with such accuracy, as to render that parallax sensible. And with this view various attempts have been made. Before the observations of M. Picard, made in 1672, it was the general opinion, that the stars did not change their position during the course of a year. Tycho Brahe and Ricciolus fancied that they had assured themselves of it from their observations; and from hence they concluded that the earth did not move round the sun, and that there was no annual parallax in the fixed stars. M. Picard, in the account of his *Voyage d' Uranibourg*, made in 1672, says that the pole star, at different times of the year, has certain variations, which he had observed for about 10 years, and which amounted to about 40" a year; from whence some, who favoured the annual motion of the earth, were led to conclude that these variations were the effect of the parallax of the earth's orbit. But it was impossible to explain it by that parallax; because this motion was in a manner contrary to what ought to follow only from the motion of the earth in her orbit.

In 1674 Dr Hook published an account of observations which he said he had made in 1669, and by which he had found that the star γ Draconis was 23" more northerly in July than in October: observations which, for the present, seemed to favour the opinion of the earth's motion, although it be now known that there could not be any truth or accuracy in them.

Flamsteed having observed the pole star with his mural quadrant, in 1680 and the following years, found that its declination was 40" less in July than in December; which observations, although very just, were yet

Aberration. yet, however, improper for proving the annual parallax; and he recommended the making of an instrument of 15 or 20 feet radius, to be firmly fixed on a strong foundation, for deciding a doubt which was otherwise not soon likely to be brought to a conclusion.

In this state of uncertainty and doubt, then, Dr Bradley, in conjunction with Mr Samuel Molineux, in the year 1725, formed the project of verifying, by a series of new observations, those which Dr Hook had communicated to the public almost 50 years before. And as it was his attempt that chiefly gave rise to this, so it was his method in making the observations, in some measure, that they followed; for they made choice of the same star, and their instrument was constructed upon nearly the same principles: but had it not greatly exceeded the former in exactness, they might still have continued in great uncertainty as to the parallax of the fixed stars. For this, and many other convenient and useful astronomical instruments, philosophers are indebted to the ingenuity and accuracy of Mr Graham.

The success of the experiment evidently depending so much on the accuracy of the instrument, this became a leading object of consideration. Mr Molineux's apparatus then having been completed, and fitted for observing, about the end of November 1725, on the third day of December following, the bright star in the head of *Draco*, marked γ by Bayer, was for the first time observed, as it passed near the zenith, and its situation carefully taken with the instrument. The like observations were made on the fifth, eleventh, and twelfth days of the same month; and there appearing no material difference in the place of the star, a farther repetition of them, at that season, seemed needless, it being a time of the year in which no sensible alteration of parallax, in this star, could soon be expected. It was therefore curiosity that chiefly urged Dr Bradley, who was then at Kew, where the instrument was fixed, to prepare for observing the star again on the 17th of the same month; when, having adjusted the instrument as usual, he perceived that it passed a little more southerly this day than it had done before. Not suspecting any other cause of this appearance, it was ascribed to the uncertainty of the observations, and that either this, or the foregoing, was not so exact as had been supposed. For which reason they proposed to repeat the observation again, to determine from what cause this difference might proceed: and upon doing it, on the 20th of December, the doctor found that the star passed still more southerly than at the preceding observation. This sensible alteration surprised them the more, as it was the contrary way from what it would have been, had it proceeded from an annual parallax of the star. But being now pretty well satisfied, that it could not be entirely owing to the want of accuracy in the observations, and having no notion of any thing else that could cause such an apparent motion as this in the star; they began to suspect that some change in the materials or fabric of the instrument itself might have occasioned it. Under these uncertainties they remained for some time; but being at length fully convinced, by several trials, of the great exactness of the instrument; and finding, by the gradual increase of the star's distance from the pole, that there must be some regular cause that produced it; they took care to examine very nicely, at the time of

each observation, how much the variation was; till **Aberration.** about the beginning of March 1726, the star was found to be 20" more southerly than at the time of the first observation: it now indeed seemed to have arrived at its utmost limit southward, as in several trials, made about this time, no sensible difference was observed in its situation. By the middle of April it appeared to be returning back again towards the north; and about the beginning of June, it passed at the same distance from the zenith, as it had done in December, when it was first observed.

From the quick alteration in the declination of the star at this time, increasing about one second in three days, it was conjectured that it would now proceed northward, as it had before gone southward, of its present situation; and it happened accordingly; for the star continued to move northward till September following, when it again became stationary; being then near 20" more northerly than in June, and upwards of 39" more northerly than it had been in March. From September the star again returned towards the south, till, in December, it arrived at the same situation in which it had been observed twelve months before, allowing for the difference of declination on account of the precession of the equinox.

This was a sufficient proof that the instrument had not been the cause of this apparent motion of the star; and yet it seemed difficult to devise one that should be adequate to such an unusual effect. A nutation of the earth's axis was one of the first things that offered itself on this occasion; but it was soon found to be insufficient; for though it might have accounted for the change of declination in γ Draconis, yet it would not at the same time accord with the phenomena observed in the other stars, particularly in a small one almost opposite in right ascension to γ Draconis, and at about the same distance from the north pole of the equator: for though this star seemed to move the same way, as a nutation of the earth's axis would have made it; yet changing its declination but about half as much as γ Draconis in the same time, as appeared on comparing the observations of both made on the same days, at different seasons of the year, this plainly proved that the apparent motion of the star was not occasioned by a real nutation; for had this been the case, the alteration in both stars would have been nearly equal.

The great regularity of the observations left no room to doubt, but that there was some uniform cause by which this unexpected motion was produced, and which did not depend on the uncertainty or variety of the seasons of the year. Upon comparing the observations with each other, it was discovered that, in both the stars above mentioned, the apparent difference of declination from the *maxima*, was always nearly proportional to the versed sine of the sun's distance from the equinoctial points. This was an inducement to think that the cause, whatever it was, had some relation to the sun's situation with respect to those points. But not being able to frame any hypothesis, sufficient to account for all the phenomena, and being very desirous to search a little farther into this matter, Dr Bradley began to think of erecting an instrument for himself at Wanstead; that, having it always at hand, he might with the more ease and certainty inquire into the laws of this new motion. The consideration likewise of being

Aberration being able, by another instrument, to confirm the truth of the observations hitherto made with that of Mr Molineux, was no small inducement to the undertaking; but the chief of all was, the opportunity he should thereby have of trying in what manner other stars should be affected by the same cause, whatever it might be. For Mr Molineux's instrument being originally designed for observing γ Draconis, to try whether it had any sensible parallax, it was so contrived, as to be capable of but little alteration in its direction; not above seven or eight minutes of a degree: and there being but few stars, within half that distance from the zenith of Kew, bright enough to be well observed, he could not, with his instrument, thoroughly examine how this cause affected stars that were differently situated, with respect to the equinoctial and solstitial points of the ecliptic.

These considerations determined him; and by the contrivance and direction of the same ingenious person, Mr Graham, his instrument was fixed up the 19th of August 1727. As he had no convenient place where he could make use of so long a telescope as Mr Molineux's, he contented himself with one of but little more than half the length, namely of 12 feet and a half, the other being 24 feet and a half long, judging from the experience he had already had, that this radius would be long enough to adjust the instrument to a sufficient degree of exactness: and he had no reason afterwards to change his opinion; for by all his trials he was very well satisfied, that when it was carefully rectified, its situation might be securely depended on to half a second. As the place where his instrument was hung, in some measure determined its radius; so did it also the length of the arc or limb, on which the divisions were made, to adjust it: for the arc could not conveniently be extended farther, than to reach to about $6\frac{1}{2}$ degrees on each side of the zenith. This however was sufficient, as it gave him an opportunity of making choice of several stars, very different both in magnitude and situation; there being more than two hundred, inserted in the British Catalogue, that might be observed with it. He needed not indeed to have extended the limb so far, but that he was willing to take in *Capella*, the only star of the first magnitude that came so near his zenith.

His instrument being fixed, he immediately began to observe such stars as he judged most proper to give him any light into the cause of the motion already mentioned. There was a sufficient variety of small ones, and not less than twelve that he could observe through all seasons of the year, as they were bright enough to be seen in the day time, when nearest the sun. He had not been long observing, before he perceived that the notion they had before entertained, that the stars were farthest north and south when the sun was near the equinoxes, was only true of those stars which are near the solstitial colure. And after continuing his observations a few months, he discovered what he then apprehended to be a general law observed by all the stars, namely, that each of them became stationary, or was farthest north or south, when it passed over his zenith at six of the clock, either in the evening or morning. He perceived also that whatever situation the stars were in, with respect to the cardinal points of the ecliptic, the apparent motion of

every one of them tended the same way, when they passed his instrument about the same hour of the day or night; for they all moved southward when they passed in the day, and northward when in the night; so that each of them was farthest north when it came in the evening about six of the clock, and farthest south when it came about six in the morning.

Though he afterwards discovered that the maxima, in most of these stars, do not happen exactly when they pass at those hours; yet, not being able at that time to prove the contrary, and supposing that they did, he endeavoured to find out what proportion the greatest alterations of declination, in different stars, bore to each other; it being very evident that they did not all change their inclination equally. It has been before noticed, that it appeared from Mr Molineux's observations, that γ Draconis changed its declination above twice as much as the before-mentioned small star that was nearly opposite to it; but examining the matter more nicely, he found that the greatest change in the declination of these stars, was as the sine of the latitude of each star respectively. This led him to suspect that there might be the like proportion between the maxima of other stars; but finding that the observations of some of them would not perfectly correspond with such an hypothesis, and not knowing whether the small difference he met with might not be owing to the uncertainty and error of the observations, he deferred the farther examination into the truth of this hypothesis, till he should be furnished with a series of observations made in all parts of the year; which would enable him not only to determine what errors the observations might be liable to, or how far they might safely be depended on; but also to judge, whether there had been any sensible change in the parts of the instrument itself.

When the year was completed, he began to examine and compare his observations; and having satisfied himself as to the general laws of the phenomena, he then endeavoured to find out the cause of them. He was already convinced that the apparent motion of the stars was not owing to a nutation of the earth's axis. The next that occurred to him, was an alteration in the direction of the plumb-line, by which the instrument was constantly adjusted; but this, upon trial, provided insufficient. Then he considered what refraction might do; but here also he met with no satisfaction. At last, through an amazing sagacity, he conjectured that all the phenomena hitherto mentioned, proceeded from the progressive motion of light, and the earth's annual motion in her orbit: for he perceived, that if light were propagated in time, the apparent place of a fixed object would not be the same when the eye is at rest, as when it is moving in any other direction but that of the line passing through the object and the eye; and that when the eye is moving in different directions, the apparent place of the object would be different. (*Hutton's Math. Dict.*).

ABERRATION, in *Optics*, the deviation or dispersion of the rays of light, when reflected by a speculum, or refracted by a lens, which prevents them from meeting or uniting in the same point, called the geometrical focus, but are spread over a small space, and produce a confusion of images. There are two species of aberration distinguished by their different causes; the

Aberration
||
Abgar.

the one arises from the figure of the lens or speculum, the other from the unequal refrangibility of the rays of light. This last species is sometimes called the Newtonian, from the name of its discoverer. See OPTICS.

ABERRATION of the Planets, is equal to the geocentric motion of the planet, the space it appears to move as seen from the earth, during the time that light employs in passing from the planet to the earth. Thus, in the sun, the aberration in longitude is constantly 20", that being the space moved by the sun, or, which is the same thing, by the earth, in the time of 8' 7", which is the time in which light passes from the sun to the earth. In like manner, knowing the distance of any planet from the earth, by proportion it will be, as the distance of the sun is to the distance of the planet, so is 8' 7" to the time of light passing from the planet to the earth: then computing the planet's geocentric motion in this time, that will be the aberration of the planet, whether it be in longitude, latitude, right ascension, or declination. (*Hutton's Math. Dict.*).

ABERYSTWTH, a market-town of Cardigan-shire, in Wales, seated on the Ridal, near its confluence with the Istwith, where it falls into the sea. It is a rich town, and has a great trade in lead, and a considerable fishery of whiting, cod, and herrings. It was formerly surrounded with walls, and fortified with a castle: but both are now in ruins. Its distance from London is 203 miles W. N. W. W. Long. 4. 20. N. Lat. 52. 17. Population 2264 in 1811.

ABESTA, or **AVESTA**, the name of one of the sacred books of the Persian magi, which they ascribe to their great founder Zoroaster. The Abesta is a commentary on two others of their religious books called *Zend* and *Pazend*; the three together including the whole system of the Ignicolæ or worshippers of fire.

ABETTOR, a law term implying one who encourages another to the performance of some criminal action, or who is art or part in the performance itself. Treason is the only crime in which abettors are excluded by law, every individual concerned being considered as a principal. It is the same with *art-and-part* in the Scots law.

ABEX, a country of Higher Ethiopia, in Africa, bordering on the Red sea, by which it is bounded on the east. It has Nubia or Sennar on the north; Sennar and Abyssinia on the west; and Abyssinia on the south. Its principal towns are Suaquem and Arkeko. It is subject to the Turks, and has the name of the beglerbeglik of Habeleth. It is about five hundred miles in length and one hundred in breadth; is a mountainous country, sandy, barren, and unhealthy, much infested with wild beasts; and the forests abound with ebony trees.

ABEYANCE, in *Law*, the expectancy of an estate. Thus if lands be leased to one person for life, with reversion to another for years, the remainder for years is in abeyance till the death of the lessee.

ABGAR, or **ABGARUS**, a name given to several of the kings of Edessa in Syria. The most celebrated of them was one who, it is said, was contemporary with Jesus Christ; and who having a distemper in his feet, and hearing of Jesus's miraculous cures, requested him by letter to come and cure him. Eusebius*, who believed that this letter was genuine, and also an answer

our Saviour is said to have returned to it, has translated them both from the Syriac, and asserts that they were taken out of the archives of the city of Edessa. The first is as follows: "Abgarus, prince of Edessa, "to Jesus the holy Saviour, who hath appeared in the "flesh in the confines of Jerusalem, greeting. I have "heard of thee, and of the cures thou hast wrought "without medicines or herbs. For it is reported thou "makest the blind to see, the lame to walk, lepers to "be clean, devils and unclean spirits to be expelled, "such as have been long diseased to be healed, and "the dead to be raised; all which when I heard concerning thee, I concluded with myself, That either "thou wast a God come down from heaven, or the "Son of God sent to do these things. I have therefore written to thee, beseeching thee to vouchsafe to "come unto me, and cure my disease. For I have "also heard that the Jews use thee ill, and lay snares "to destroy thee. I have here a little city, pleasantly "situated, and sufficient for us both. **ABGARUS.**" To this letter, Jesus, it is said, returned an answer by Annanias, Abgarus's courier; which was as follows: "Blessed art thou, O Abgarus! who hast believed in "me whom thou hast not seen; for the Scriptures say "of me, They who have seen me have not believed in "me, that they who have not seen, may, by believing, "have life. But whereas thou writest to have me "come to thee, it is of necessity that I fulfil all things "here for which I am sent; and having finished them, "to return to him that sent me: but when I am returned to him, I will then send one of my disciples "to thee, who shall cure thy malady, and give life to "thee and thine. **JESUS.**" After Jesus's ascension, Judas, who is also named Thomas, sent Thaddeus, one of the seventy, to Abgarus; who preached the gospel to him and his people, cured him of his disorder, and wrought many other miracles: which was done says Eusebius, A. D. 43.—Though the above letters are acknowledged to be spurious by the candid writers of the church of Rome; several Protestant authors, as Dr Parker, Dr Cave, and Dr Grabe, have maintained that they are genuine, and ought not to be rejected.

ABGILLUS, **JOHN**, surnamed Prester John, was son to a king of the Friscii; and, from the austerity of his life, obtained the name of *Prester*, or Priest. He attended Charlemagne in his expedition to the Holy Land; but instead of returning with that monarch to Europe, it is pretended that he gained mighty conquests, and founded the empire of the Abyssines, called, from his name, the empire of Prester John. He is said to have written the history of Charlemagne's journey into the Holy Land, and his own into the Indies; but they are more probably trifling romances, written in the ages of ignorance.

ABIANS, anciently a people of Thrace, or (according to some authors of Scythia. They had no fixed habitations; they led a wandering life. Their houses were waggons, which carried all their possessions. They lived on the flesh of their herds and flocks, on milk and cheese, chiefly on that of mare's milk. They were unacquainted with commerce. They only exchanged commodities with their neighbours. They possessed lands, but they did not cultivate them. They assigned their agriculture to any who would undertake it, reserving only to themselves

Abgar
||
Abians.

* Eccl.
Hist. lib. i.
cap. 13.

Abians a tribute; which they exacted, not with a view to live in affluence, but merely to enjoy the necessaries of life. They never took arms but to oblige those to make good a promise to them by whom it had been broken. They paid tribute to none of the neighbouring states. They deemed themselves exempt from such an imposition; for they relied on their strength and courage, and consequently thought themselves able to repel any invasion. The Abians, we are told, were a people of great integrity. This honourable eulogium is given them by Homer. (Strabo).

ABIATHAR, high priest of the Jews, son to Ahimelech, who had borne the same office, and received David into his house. This so enraged Saul, who hated David, that he put Ahimelech to death, and 81 priests; Abiathar alone escaped the massacre. He afterwards was high priest; and often gave King David testimonies of his fidelity, particularly during Absalom's conspiracy, at which time Abiathar followed David, and bore away the ark. But after this, conspiring with Adonijah, in order to raise him to the throne of King David his father; this so exasperated Solomon against him, that he divested him of the priesthood, and banished him, A. M. 3021, before Christ 1014.

ABIB, signifying an ear of corn, a name given by the Jews to the first month of their ecclesiastical year, afterwards called *Nisan*. It commenced at the vernal equinox; and according to the course of the moon, by which their months were regulated, answered to the latter part of our March and beginning of April.

ABIDING by WRITINGS, in *Scots Law*: When a person founds upon a writing alleged to be false, he may be obliged to declare judicially, whether he will stand or abide by it as a true deed.

ABIES, the FIR-TREE. See PINUS, BOTANY Index.

ABIGEAT, an old law term, denoting the crime of stealing cattle by droves or herds. This crime was severely punished; the delinquent being often condemned to the mines, banishment, and sometimes capitally.

ABIHU, brother to Nadab, and son to Aaron. The two former had the happiness to ascend Mount Sinai with their father, and there to behold the glory of God: but afterward putting strange fire into their censers, instead of the sacred fire commanded by God, fire rushing upon them killed them. Though all the people bewailed this terrible catastrophe, Moses forbade Aaron and his two sons Eleazar and Ithamar to join in the lamentation.

ABII SCYTHÆ, taken by Strabo to denote the European Sarmatæ, bordering on the Thracians and Bastanæ: They were commended by Curtius for their love of justice, and by Ammiesius for their contempt of earthly things.

ABIMELECH, king of Gerar, a country of the Philistines, was contemporary with Abraham. This patriarch and his family being there, his wife Sarah, though 90 years of age, was not safe in it; for Abimelech carried her off, and was so enamoured of her, that he resolved to marry her. Abraham did not declare himself Sarah's husband; but gave out she was his sister. But the king being warned in a dream, that she was married to a prophet, and that he should die

if he did not restore her to Abraham, the king obeyed; at the same time reproving Abraham for his disingenuity; who thereupon, among other excuses, said she was really his sister, being born of the same father, though of a different mother. Abimelech afterwards gave considerable presents to Abraham; and a covenant, that of Beersheba, was entered into between them, A. M. 2107. After the death of Abraham, there being a famine in the neighbouring countries, Isaac his son also withdrew into Gerar, which was then likewise governed by a king called

ABIMELECH, probably the successor of the former. Here Rebekah's beauty forced her husband to employ Abraham's artifice. Abimelech discovering that they were nearly related, chid Isaac for calling his wife his sister; and at the same time forbade all his subjects, upon pain of death, to do the least injury to Isaac or Rebekah. Isaac's prosperity lost him the king's friendship, and he was desired to go from among them. He obeyed; but Abimelech afterwards entered into a covenant with him, A. M. 2200.

ABIMELECH, the natural son of Gideon, by his concubine. His violent acts and death are recorded in Judges, chap. ix. A. M. 2769.

ABINGDON, a market-town in Berkshire, situated on a branch of the Thames, derives its name from an ancient abbey. The streets, which are well paved, terminate in a spacious area, in which the market is held; and in the centre of this area is the market-house, which is supported on lofty pillars, with a large hall of freestone above, in which the summer assizes for the county are held, and other public business done, the Lent assizes being held at Reading. It has two churches; one dedicated to St Nicholas, and the other to St Helena: the latter is adorned with a spire, and both are said to have been erected by the abbots of Abingdon. Here are also two hospitals, one for six, and the other for thirteen poor men, and as many poor women; a free school; and a charity school. The town was incorporated by Queen Mary. It sends two members to parliament, who are chosen by the inhabitants at large not receiving alms. Its great manufactures are sail-cloth, sacking, and especially malt, large quantities of which are sent by water to London. It is seven miles south of Oxford, 47 east of Gloucester, and 55 west of London. This town is supposed by Bishop Gibson to be the place called, in the Saxon annals, *Cloveshoo*. W. Long. 1. 12. N. Lat. 51. 42. Population 4801 in 1811.

ABINTESTATE, in *Civil Law*, is applied to a person who inherits the right of one who died intestate or without making a will. See INTESTATE.

ABIPONIANS, a tribe of American Indians, who formerly inhabited the district of *Chaks* in Paraguay; but the hostilities of the Spaniards have now obliged them to remove southward into the territory lying between Santa Fe and St Jago. The only account we have of them is that published by M. Dobrizhoffer in 1785. This gentleman, who lived seven years in their country, informs us that they are not numerous, the whole nation not much exceeding 5000; for which he assigns as a reason an unnatural custom among their women of sometimes destroying their own children, from motives of jealousy lest their husbands should take other mates during the long time they give suck, which

Abiponians
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Ablacta-
tion.

which is not less than two years. They are naturally white, but, by exposure to the air and smoke, become of a brown colour. They are a strong and hardy race of people; which our author attributes to their marrying so late, an Abiponian seldom or never thinking of marriage till 30 years of age. They are greatly celebrated on account of their chastity and other virtues; though, according to our author, they have no knowledge of a Deity. They make frequent incursions into the territories of the Spaniards, mounted on the horses which run wild in those parts. They have a kind of order of chivalry for their warriors; and are so formidable, that 100 of their enemies will fly before ten of these horsemen. The hatred which these savages, whose manners, though rude and uncultivated, are in many respects pure and virtuous, bear to the Spaniards, is invincible. "These pretended Christians," says our author, "who are the scum of the Spanish nation, practise every kind of fraud and villany among these poor barbarians; and their corrupt and vicious morals are so adapted to prejudice the Abiponians against the Christian religion, that the Jesuit missionaries have, by a severe law, prohibited any Spaniard from coming, without a formal permission, into any of their colonies." —From his account of the success of the Jesuits in converting them to Christianity, however, it does not appear that they have been able to do more than bribe them to a compliance with the ceremonies of the Popish superstition; so that in general they are quite ignorant and uncivilized; a most striking instance of which is, that in counting they can go no further than three; and all the art of the Jesuits to teach them the simplest use and expression of numbers has proved unsuccessful.

ABIRAM, a seditious Levite, who, in concert with Korah and Dathan, rebelled against Moses and Aaron, in order to share with them in the government of the people; when Moses ordering them to come with their censers before the altar of the Lord, the earth suddenly opened under their feet, and swallowed up them and their tents; and at the same instant fire came from heaven, and consumed 250 of their followers. Numb. chap. xvi.

ABISHAI, son of Zeruiah, and brother to Joab, was one of the celebrated warriors who flourished in the reign of David: he killed with his own hand 300 men, with no other weapon but his lance; and slew a Philistine giant, the iron of whose spear weighed 300 shekels. 1 Sam. chap. xxvi. 2 Sam. chap. xxiii.

ABJURATION, in our ancient customs, implied an oath, taken by a person guilty of felony, and who had fled to a place of sanctuary, whereby he solemnly engaged to leave the kingdom for ever.

ABJURATION is now used to signify the renouncing, disclaiming, and denying upon oath, the Pretender to have any kind of right to the crown of these kingdoms.

ABJURATION of Heresy, the solemn recantation of any doctrine as false and wicked.

ABLACTATION, or weaning a child from the breast. See **WEANING**.

ABLACTATION, among the ancient gardeners, the same with what is now called **GRAFTING by approach**, is a method of engrafting, by which the scion of one tree being for some time united to the stock of another, is afterwards cut off, and, as it were, weaned from the parent tree.

ABLAI, a country of Great Tartary, the inhabitants of which are called *Buchars* or *Buchares*. See **ABLAY**.

ABLACQUEATION, an old term in *Gardening*, signifies the operation of removing the earth, and barring the roots of trees in winter, to expose them more freely to the air, rain, snows, &c.

ABLANCOURT. See **PERROT**.

ABLATIVE, in *Grammar*, the sixth case of Latin nouns. The word is formed from *auferre*, "to take away." Priscian also calls it the *comparative case*; as serving among the Latins, for comparing, as well as taking away.

The **ABLATIVE** is opposite to the **DATIVE**; the first expressing the action of taking away, and the latter that of giving.

In English, French, &c. there is no precise mark whereby to distinguish the ablative from other cases; and we only use the term in analogy to the Latin. Thus, in the two phrases, *the magnitude of the city*, and *he spoke much of the city*; we say, that *of the city* in the first is *genitive*, and in the latter *ablative*; because it would be so, if the two phrases were expressed in Latin.

The question concerning the Greek ablative has been the subject of a famous literary war between two great grammarians, Frischlin and Crusius; the former maintaining, and the latter opposing, the reality of it. The dispute still subsists among their respective followers. The chief reason alleged by the former is, that the Roman writers often joined Greek words with the Latin prepositions which govern ablative cases, as well as with nouns of the same case. To which their opponents answer, that the Latins anciently had no ablative themselves; but instead thereof, made use, like the Greeks, of the dative case; till at length they formed an ablative, governed by prepositions, which were not put before the dative: that, at first, the two cases had always the same termination, as they still have in many instances: but that this was afterwards changed in certain words. It is no wonder then, that the Latins sometimes join prepositions which govern an ablative case, or nouns in the ablative case, with Greek datives, since they were originally the same; and that the Greek dative has the same effect as the Latin ablative.

ABLATIVE ABSOLUTE, in *Grammar*, is a phrase detached or independent of the other parts of a sentence or discourse. In the Latin language it is frequent, and it has been adopted by the moderns.

ABLAY, in *Geography*, a country of Great Tartary, governed by a Calmuck chief, but subject to Russia, to obtain its protection. It lies east of the river Irtysh, and extends 500 leagues along the southern frontiers of Siberia, from E. Long. 72° to 83°. N. Lat. from 51° to 54°.

ABLE, or **ABEL**, THOMAS, chaplain to Queen Catherine, consort to Henry VIII. distinguished himself by his zeal in opposing the proceedings against that unfortunate princess for a divorce. For this purpose he wrote a piece, entitled "*Tractatus de non dissolvendo Henrici et Catharinæ matrimonio*, i. e. "A Treatise proving that the marriage of King Henry and Queen Catharine ought not to be dissolved." But the title of the book, according to Bishop Tanner, was

Invicta

Ablai
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Able.

Able
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Abner.

Invicta Veritas. He took the degree of bachelor of arts at Oxford on the 4th of July 1513, and that of master of arts on the 27th of July 1516. In 1534 he fell under a prosecution for being concerned in the affair of Elizabeth Barton, called the *Holy Maid of Kent*. This was an infamous impostor, suborned by the monks to use strange gesticulations, exhibit fictitious miracles, and to feign the gift of prophecy; and so well did she act her part, that she drew some persons of respectability to her interest: but being detected, she was condemned and executed, after discovering the names of her principal accomplices and instigators. On her account Able was charged with misprision of treason, by stat. 25 Hen. VIII.; and being also one of those who denied the king's supremacy over the church, he was apprehended and imprisoned; during which time his confinement was so rigorous, that the keeper of Newgate was committed to Marshalsea prison for suffering him to go out upon bail. He was afterwards hanged, drawn, and quartered, at Smithfield in 1540. Bouchier gives him the character of a very learned man; and tells us, that he used to teach the queen music and the learned languages.

ABLECTI, in Roman antiquity, a select body of soldiers chosen from among those called EXTRAORDINARI.

ABLEGMINA, in Roman antiquity, those choice parts of the entrails of victims which were offered in sacrifice to the gods. They were sprinkled with flour, and burnt upon the altar; the priests pouring some wine on them.

ABLOE, in *Geography*, a town of Little Tartary, which lies between the river Dnieper and the Black sea. E. Long. 33. 15. N. Lat. 46. 20.

ABLUENTS, in *Medicine*, the same with diluters or DILUENTS.

ABLUTION, in a general sense, signifies the washing or purifying something with water.

ABLUTION, in a religious sense, a ceremony in use among the ancients, and still practised in several parts of the world: it consisted in washing the body, which was always done before sacrificing, or even entering their houses. Ablutions appear to be as old as any ceremonies, and external worship itself. Moses enjoined them; the heathens adopted them; and Mahomet and his followers have continued them: thus they have got footing among most nations, and make a considerable part of most established religions.—The Egyptian priests had their diurnal and nocturnal ablutions; the Grecians their sprinklings; the Romans their lustrations and lavations; the Jews their washing of hands and feet, beside their baptisms.—The ancient Christians had their ablutions before communion; which the Romish church still retain before their mass, sometimes after. The Syrians, Copts, &c. have their solemn washings on Good Friday: the Turks their greater and lesser ablutions; their Ghast and Wodou, their Aman, Taharat, &c.

ABNER, the son of Ner, father-in-law to Saul, and general of all his forces, served him on all occasions with fidelity and courage. After the death of that prince, Abner set Ishbosheth, Saul's son, on the throne. A war breaking out between the tribe of Judah, who had elected David king, and Israel, Abner marched against that prince with the flower of his troops, but was defeated. Abner afterward, being disgusted,

went over to David, and induced the chiefs of the army and the elders of Israel to declare for him. He was received by David with every mark of affection, which gave offence to Joab, by whom he was insidiously put to death, A. M. 2956.

ABNOBA, now ABENOW, in *Geography*, a long range of mountains in Germany, extending from the Rhine to the Necker, and having different names according to the different countries through which they stretch. About the river Maine they are called the *Oden* or *Otenwald*; between Hesse and Franconia, the *Spessart*; and about the duchy of Wirtemberg, where the Danube takes its rise, they receive the name of *Baar*.

ABO, a maritime town of Finland, situated on the promontory formed by the gulfs of Finland and Bothnia, 120 miles north-east from Stockholm, in E. Long. 22. 7. and N. Lat. 60. 28. It belonged formerly to Sweden, but was transferred to Russia with the province of Finland in 1809. It is built on both sides of the river Aurajocki, which have a communication by a wooden bridge. The streets and lanes of Abo amount to 102; the number of houses to 1100, which in 1780 contained above 2000 families. In 1791 the number of inhabitants was 11,500.

A gymnasium was established at Abo by Gustavus Adolphus in 1626, which was converted by Queen Christina, in 1640, into an academy or university, in which are now taught anatomy, natural history, chemistry, and economics. The library founded by Queen Christina consists of above 10,000 volumes, besides manuscripts, ancient coins, medals, &c. The school of anatomy is in considerable repute; and enjoys, it is said, one very extraordinary privilege. By a particular regulation, all persons who hold lands or pensions from the crown are bound to leave their bodies to be dissected for the instruction of the students.

The trade of Abo is considerable. The exports consist of iron, copper, pitch, tar, deals, &c. The imports are tobacco, coffee, sugar, wine, salt, grain, hemp, and spiceries. In Abo are manufactured silk ribbands, fustian, sail-cloth, leather, tiles, watches and clocks, paper, sugar, and tobacco. The plantations of tobacco in this neighbourhood produce not less than 152,000 cwt. annually. (*Acerbi's Travels*).

ABO-HUS, or ABO-SLOT, a very ancient castle in Finland, situated at the mouth of the river Aura, was the residence of Duke John, and the prison of King Eric in the 16th century. It is at present employed as a magazine for corn and gunpowder, and as a prison for state offenders.

ABOARD, the inside of a ship. Hence any person who enters a ship is said to *go aboard*: but when an enemy enters in the time of battle, he is said to *board*; a phrase which always implies hostility.—To *fall aboard of*, is to strike or *encounter* another ship when one or both are in motion, or to be driven upon a ship by the force of the wind or current.—*Aboard-main-tack*, the order to draw the main-tack, i. e. the lower-corner of the main-sail, down to the CHESS-TREE.

ABOASAR, in *Geography*, a village in Lower Egypt, supposed to be the ancient Busiris.

ABOCCIS, in *Ancient Geography*, the Abuncis of Ptolemy, a town of Ethiopia, situated on the western side of the Nile near the great cataract.

Abner
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Aboccis.

Abocro
||
Abomasus.

ABOCRO, or ABORREL, in *Geography*, a town near the river Ankobar or Cobre, on the African Gold coast. It gives name to a republican province.

ABOLA, in *Geography*, a division of the Agow, in Abyssinia, is a narrow valley, through which runs a river of the same name, whose waters receive many tributary streams from the lofty, rugged, and woody mountains that form the valley. In none of the rivers are any fish found, which Bruce ascribes to their being dried up in the summer, and great rapidity in winter.

ABOLITION, implies the act of annulling, destroying, making void, or reducing to nothing. In our law, it signifies the repealing any law or statute. The leave given by a prince or judge to a criminal accuser to desist from farther prosecution of the accused, is in the most appropriate sense denominated *abolition*.

ABOLITION is particularly used among civilians, for remitting the punishment of a crime. It is, in this sense, a kind of amnesty; the punishment, not the infamy, is taken off.

ABOLITION, in the Roman law, is the annulling a prosecution, or legal accusation: and in this sense, it is different from amnesty; for, in the former, the accusation might be renewed by the same prosecutor, but in the latter, it was extinguished for ever. Within 30 days after a public *abolition*, the same accuser, with the prince's license, was allowed to renew the charge; after a private *abolition*, another accuser might renew it, but the same could not. *Abolition* was also used for expunging a person's name from the public list of the accused, hung up in the treasury. It was either public, as that under Augustus, when all the names which had long hung up, were expunged at once; or private, when it was done at the motion of one of the parties. *Abolition* of debts, according to the laws of the Theodosian code, was sometimes granted to those who were indebted to the fiscus. A medal of the emperor Adrian represents that prince with a sceptre in his left hand, and a lighted torch in his right, with which he sets fire to several papers in presence of the people, who testify their joy and gratitude by lifting up their hands towards heaven. The legend on the medal is, *Reliqua vetera h. s. nummis abolita*.

ABOLLA, in antiquity, a warm kind of garment, lined or doubled, worn by the Greeks and Romans, chiefly out of the city, in following the camp.—Critics and antiquaries are greatly divided as to the form, use, kinds, &c. of this garment. Papias makes it a species of the *toga*, or gown; but Nonnius, and most others, suppose it to be a species of the *pallium*, or cloak. The *abolla* seems rather to have stood opposed to the *toga*, which was a garment of peace, as the *abolla* was of war; at least Varro and Martial place them in this opposite light. There seem to have been different kinds of *abollæ*, appropriated to different characters and occasions. Even kings appear to have used the *abolla*: Caligula was offended with King Ptolemy for appearing at the shows in a purple *abolla*, the splendour of which drew the eyes of the spectators from the emperor to himself.

ABOMASUS, ABOMASUM, or ABOMASIUS, names of the fourth stomach of ruminating animals. It is in the abomasus of calves and lambs that the runnet or curdling is formed wherewith milk is curdled. See ANATOMY, Part II.

ABOMINATION, a term used in Scripture with regard to the Hebrews, who, being shepherds, are said to have been an abomination to the Egyptians, because they sacrificed the sacred animals of that people, as oxen, goats, sheep, &c. which the Egyptians esteemed as abominations, or things unlawful. The term is also applied in the sacred writings to idolatry and idols, because the worship of idols is in itself an abominable thing, and at the same time ceremonies observed by idolaters were always attended with licentiousness and other odious and abominable actions. The *abomination of desolation*, foretold by the prophet Daniel, is supposed to imply the statue of Jupiter Olympius, which Antiochus Epiphanes caused to be placed in the temple of Jerusalem. And the *abomination of desolation*, mentioned by the Evangelists, signifies the ensigns of the Romans, during the last siege of Jerusalem by Titus, on which the figures of their gods and emperors were embroidered, and placed upon the temple after it was taken.

ABON, ABONA, or ABONIS, in *Ancient Geography*, a town and river of Albion. The town, according to Camden, is Abingdon; and the river, Abhon or Avon. But by Antonine's Itinerary, the distance is nine miles from the Venta Silurum, or Caer-went; others, therefore, take the town to be Porshut, at the mouth of the river Avon, near Bristol. Abhon or Avon, in the Celtic language, denotes a river.

ABORAS, in *Ancient Geography*, by Xenophon called Araxes, a river of Mesopotamia, which flows into the Euphrates at Circesium. In the negotiation between Dioclesian and Narses, near the end of the third century, it was fixed as the boundary between the Roman and Persian empires.

ABORIGINES, in history, (Dionysius of Halicarnassus, Livy, Virgil); originally a proper name; given to a certain people in Italy, who inhabited the ancient Latium, or country now called *Campagna di Roma*. In this sense the Aborigines are distinguished from the Janigenæ, who, according to the false Berossus, inhabited the country before them; from the Siculi, whom they expelled; from the Grecians, from whom they descended; from the Latins, whose name they assumed after their union with Æneas and the Trojans; lastly, from the Ausonii, Volsci, Oenotrii, &c. neighbouring nations in other parts of the country. Whence this people came by the appellation is much disputed. St Jerome says, they were so called, as being *absque origine*, the primitive planters of the country after the flood: Dionysius of Halicarnassus accounts for the name, as denoting them the founders of the race of inhabitants of that country: others think them so called as being originally Arcadians, who claimed to be earth-born, and not descended from any people. Aurelius Victor suggests another opinion, viz. that they were called *Aborigines*, q. d. *Aberrigines*, from *ab*, "from," and *errare*, "to wander;" as having been before a wandering people. Pausanias rather thinks they were thus called *απο ορει*, "from mountains; which opinion seems confirmed by Virgil, who, speaking of Saturn, the legislator of this people, says,

*Is genus indocile ac dispersum montibus altis
Composuit, legesque dedit.*—

The Aborigines were either the original inhabitants of the country, settled there by Janus, as some imagine;

Abomina-
tion
||
Aborigines.

Aborigines, gine; or by Saturn, or Cham, or others; not long after the dispersion, or even, as some think, before it: Or, they were a colony sent from some other nation; who expelling the Siculi, the ancient inhabitants, settled in their place. About this mother nation there is great dispute. Some maintain it to be the Arcadians, parties of whom were brought into Italy at different times; the first under the conduct of Oenotrius, son of Lycaon, 450 years before the Trojan war; a second from Thessaly; a third under Evander, 60 years before the Trojan war; besides another under Hercules; and another of Lacedæmonians, who fled from the severe discipline of Lycurgus: all these uniting, are said to have formed the nation or kingdom of the Aborigines. Others will have them of barbarian rather than Grecian origin, and to have come from Scythia; others from Gaul. Lastly, Others will have them to be Canaanites, expelled by Joshua.

The term *Aborigines*, though so famous in antiquity, is used in modern geography only occasionally as an appellative. It is given to the primitive inhabitants of a country, in contradistinction to colonies, or new races of people.

ABORTION, in *Midwifery*, the premature exclusion of a fœtus. See *MIDWIFERY*.

The practice of procuring abortions was prohibited by the ancient Greek legislators Solon and Lycurgus. Whether or not it was permitted among the Romans, has been much disputed. It is certain the practice, which was by them called *visceribus vim inferre*, was frequent enough; but whether there was any penalty on it before the emperors Severus and Antonine, is the question. Nodt maintains the negative; and further, that those princes only made it criminal in one particular case, viz. of a married woman's practising it out of resentment against her husband, in order to defraud him of the comfort of children: this was ordered to be punished by a temporary exile. The foundation on which the practice is said to have been allowed, was, that the fœtus, while *in utero*, was reputed as a part of the mother, ranked as one of her own viscera, over which she had the same power as over the rest: besides, that it was not reputed as a man, *homo*; nor to be alive, otherwise than as a vegetable: consequently, that the crime amounted to little more than that of plucking unripe fruit from the trees. Seneca represents it as a peculiar glory of Helvia, that she had never, like other women, whose chief study is their beauty and shape, destroyed the fœtus in her womb. The primitive fathers, Athenagoras, Tertullian, Minutius Felix, Augustin, &c. declaimed loudly against the practice as virtual murder. Several councils have condemned it. Yet we are told that the modern Romish ecclesiastical laws allow of dispensations for it. Egane mentions the rates at which a dispensation for it may be had.

The practice of artificial abortion is chiefly in the hands of women and nurses, rarely in that of physicians; who, in some countries, are not admitted to the profession without abjuring it. Hippocrates, in the oath he would have enjoined on all physicians, includes their not giving the *pessus abortivus*, though elsewhere he gives the formal process whereby he himself procured in a young woman a miscarriage. It may, however, be observed, that often all the powers of art

prove ineffectual, and no less often do the attempts prove the means of punishment by their fatal consequences. See *ABORTION, SUPPLEMENT*.

ABORTION, among gardeners, signifies such fruits as are produced too early, and never arrive at maturity.

ABORTIVE, is, in general, applied to whatever comes before its legitimate time, or to any design which miscarries.

ABORTIVE Corn, a distemper of corn mentioned by M. Tillet, and suspected to be occasioned by insects. It appears long before harvest, and may be known by a deformity of the stalk, the leaves, the ear, and even the grain.

ABORTIVE Vellum, is made of the skin of an abortive calf.

ABOTRITES, or **ABODRITES**, in *History*, the name of a people bordering on Bulgaria, in that part of Dacia contiguous to the Danube. The country of the Abodrites, now called Mecklenburg, was a part of the ancient Vandalia.

ABOUKIR, a small town of Egypt, situated in the desert between Alexandria and Rosetta. It is the ancient Canopus, and is situated, according to Mr Savary, six leagues from Pharos. Pliny says, from the testimonies of antiquity, that it was formerly an island: and its local appearance makes this credible. The town is built upon a rock, which forms a handsome road for shipping, and was out of the reach of inundations. In the bay of Aboukir, a signal victory was obtained in 1798 by the English fleet over the French fleet. The town was taken from the Turks, after a vigorous defence, by the French in 1799, and retaken by the English in 1801.

ABOULFEDA, a celebrated Arabian writer. See *SUPPLEMENT*.

ABOUT, the situation of a ship immediately after she has tacked, or changed her course by going about and standing on the other tack.—*About ship!* the order to the ship's crew for tacking.

ABOUTIGE, a town of Upper Egypt, in Africa, near the Nile, where they made the best opium in all the Levant. It was formerly a large, but now is a mean place. N. Lat. 26. 50.

ABRA, a silver coin struck in Poland, and worth about one shilling sterling. It is current in several parts of Germany, at Constantinople, Astracan, Smyrna, and Grand Cairo.

ABRABANEL, **ABARBANEL**, or **AVRAVANEL**, **ISAAC**, a celebrated rabbi, descended from King David, and born at Lisbon A. D. 1437. He became counsellor to Alphonso V. king of Portugal, and afterwards to Ferdinand the Catholic; but in 1492 was obliged to leave Spain with the other Jews. In short, after residing at Naples, Corfu, and several other cities, he died at Venice in 1508, aged 71. Abrabanel passed for one of the most learned of the rabbis; and the Jews gave him the names of the Sage, the Prince, and the Great Politician. We have a commentary of his on all the Old Testament, which is pretty scarce: he there principally adheres to the literal sense; and his style is clear, but a little diffuse. His other works are, *A Treatise on the Creation of the World*; in which he refutes Aristotle, who imagined that the world was eternal: *A Treatise on the Explication of the Prophecies*.

Abortion

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Abrahamel.

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by Serenus Samonicus as an antidote against agues and several other diseases. It was to be written upon a piece of paper as many times as the word contains letters, omitting the last letter of the former every time, as in the margin †, and repeated in the same order; and then suspended about the neck by a linen thread. *Abracadabra* was the name of a god worshipped by the Syrians; so wearing his name was a sort of invocation of his aid; a practice which, though not more useful, yet was less irrational, than is the equally heathenish practice among those who call themselves Christians, of wearing various things, in expectation of their operating by a sympathy, whose parents were Ignorance and Superstition.

Many extraordinary particulars have been told relating to his conversion from idolatry. It is a pretty general opinion, that he sucked in the poison with his milk; that his father made statues, and taught that they were to be worshipped as gods*. Some Jewish authors relate †, that Abraham followed the same trade with Terah for a considerable time. Maimonides ‡ says, that he was bred up in the religion of the Sabæans, who acknowledged no deity but the stars; that his reflections on the nature of the planets, his admiration of their motions, beauty and order, made him conclude there must be a being superior to the machine of the universe, a being who created and governed it; however, according to an old tradition, he did not renounce Paganism till the 50th year of his age. It is related ||, that his father, being gone a journey,

Abraham is said to have been well skilled in many sciences, and to have wrote several books. Josephus † tells us that he taught the Egyptians arithmetic and geometry; and according to Eupolemus and Artapan, he instructed the Phœnicians, as well as the Egyptians, in astronomy. A work which treats of the creation has been long ascribed to him: it is mentioned in the Talmud ‡, and the rabbis Chanina and Hoschia used to read it on the eve before the Sabbath. In the first ages of Christianity, according to St Epiphanius ||, a heretical sect, called *Sethinians*, dispersed a piece which had the title of *Abraham's Revelation*. Origen mentions also a treatise supposed to be wrote by this patriarch. All the several works which Abraham composed in the plains of Mamre, are said to be contained in the library of the monastery of the Holy Cross on Mount Amaria in Ethiopia §. The book on the creation was printed at Paris 1552, and translated into Latin by Postel: Rittangel, a converted Jew, and professor at Königsberg, gave also a Latin translation of it, with remarks, in 1642.

ABRAHAM *Ben Chaila*, a Spanish rabbi, in the 13th century, who professed astrology, and assumed the character of a prophet. He pretended to predict the coming of the Messiah, which was to happen in the year 1358; but fortunately he died in 1303, fifty-five years before the time when the prediction was to be fulfilled.

* *Suidas* in they were to be worshipped as gods *. Some Jewish
Εσπερ. See authors relate †, that Abraham followed the same trade
Jos. xxiv. 2. with Terah for a considerable time. Maimonides †
† *Aquid Ge-* says, that he was bred up in the religion of the Sa-
nebrand. in bæans, who acknowledged no deity but the stars; that
Chron. his reflections on the nature of the planets, his admira-
† *More Ne-* tion of their motions, beauty and order, made him
vosh. c. 29.

|| Heidegger, Hist.
Patriarch.
tom. iii.
p. 36.

† *Tradit.*
Hebraic. in
Genesin.
 * It is the
 proper
 name of a
 city, and it
 also signifi-
 ed *fire*. The
 Lat. version
 Esdras ix.
 has it thus:
Qui eligisti
eum de igne
Chaldeo-

† Heidegger
Hist. Patri-
arch. tom.
ii, p. 143.
|| Advers.
Hær. p.

§ Kirchem's
Treatise of
Libraries,
p. 142.

Abraham
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Abraxas.

Abraxas
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Abridgement.

fulfilled. He wrote a book, *De Nativitatibus*, which was printed at Rome in 1545.

ABRAHAM USQUE, a Portuguese Jew, who, in conjunction with Tobias Athias, translated the Hebrew Bible into Spanish. It was printed at Ferrara, in 1553, and reprinted in Holland in 1630. This Bible, especially the first edition, which is most valuable, is marked with stars at certain words, which are designed to show that these words are difficult to be understood in the Hebrew, and that they may be used in a different sense.

ABRAHAM, *Nicholas*, a learned Jesuit, born in the diocese of Toul, in Lorrain, in 1489. He obtained the rank of divinity professor in the university of Pont-a-Mousson, which he enjoyed 17 years, and died September 7. 1655. He wrote Notes on Virgil and on Nonnius; A Commentary on some of Cicero's Oration, in two vols. folio; an excellent collection of theological pieces in folio, entitled *Pharus Veteris Testamenti*; and a Hebrew Grammar in verse.

ABRAHAMITES, an order of monks exterminated for idolatry by Theophilus in the ninth century. Also the name of another sect of heretics who had adopted the errors of Paulus. See PAULICIANS.

ABRANTES, a town of Portugal, in Estremadura, seated on an eminence, in the midst of gardens and olive trees, near the river Tajo, belongs to a marquis of the same name. It contains 35,000 inhabitants, four convents, an alms-house, and an hospital. W. Long. 7. 55. N. Lat. 39. 21.

ABRASAX, or ABRAXAS, the supreme god of the Basilidian heretics. It is a mystical or cabalistic word, composed of the Greek letters $\alpha, \beta, \gamma, \delta, \epsilon, \zeta, \eta, \theta$, which together, according to the Grecian mode of numeration, make up the number 365. For Basilides taught, that there were 365 heavens between the earth and the empyrean; each of which heavens had its angel or intelligence, which created it; each of which angels likewise was created by the angel next above it; thus ascending by a scale to the Supreme Being, or first Creator. The Basilidians used the word *Abraxas* by way of charm or amulet.

ABRASION is sometimes used among medical writers for the effect of sharp corrosive medicines or humours in wearing away the natural mucus which covers the membranes, and particularly those of the stomach and intestines. The word is composed of the Latin *ab* and *rado*, to shave or scrape off.

ABRAVANNUS, in *Ancient Geography*, the name of a promontory and river of Galloway in Scotland, so called from the Celtic term *Aber*, signifying either the mouth of a river or the confluence of two rivers, and *Avon*, a river.

ABRAUM, in *Natural History*, a name given by some writers to a species of red clay, used in England by the cabinetmakers, &c. to give a red colour to new mahogany wood. We have it from the isle of Wight; but it is also found in Germany and Italy.

ABRAXAS, an antique stone with the word *abraxas* engraven on it. They are of various sizes, and most of them as old as the third century. They are frequent in the cabinets of the curious; and a collection of them, as complete as possible, has been desired by several. There is a fine one in the abbey of St Genevieve, which has occasioned much speculation. Most of them seem

to have come from Egypt: whence they are of some use for explaining the antiquities of that country. Sometimes they have no other inscription besides the word: but others have the names of saints, angels, or Jehovah himself annexed; though most usually the name of the Basilidian god. Sometimes there is a representation of Isis sitting on a lotus, or Apis surrounded with stars; sometimes monstrous compositions of animals, obscene images, Phalli and Ithyphalli. The graving is rarely good, but the word on the reverse is sometimes said to be in a more modern style than the other. The characters are usually Greek, Hebrew, Coptic, or Etrurian, and sometimes of a mongrel kind, invented, as it would seem, to render their meaning the more inscrutable. It is disputed whether the Veronica of Montreuil, or the granite obelisk mentioned by Gori, be *Abraxases*.

ABREAST (a sea term), side by side, or opposite to; a situation in which two or more ships lie, with their sides parallel to each other, and their heads equally advanced. This term more particularly regards the line of battle at sea, where on the different occasions of attack, retreat, or pursuit, the several squadrons or divisions of a fleet are obliged to vary their dispositions, and yet maintain a proper regularity by sailing in right or curved lines. When the line is formed abreast, the whole squadron advances uniformly, the ships being equally distant from and parallel to each other, so that the length of each ship forms a right angle with the extent of the squadron or line abreast. The commander in chief is always stationed in the centre, and the second and third in command in the centres of their respective squadrons.—*Abreast*, within the ship, implies on a line with the beam, or by the side of any object aboard; as, the frigate sprung a leak *abreast* of the main hatchway, i. e. on the same-line with the main hatchway, crossing the ship's length at right angles, in opposition to *AFORE* or *ABAFT* the hatchway.

ABRETENE, or ABRETTINE, in *Ancient Geography*, a district of Mysia, in Asia. Hence the epithet *Abrettenus* given to Jupiter (Strabo); whose priest was Cleon, formerly at the head of a gang of robbers, and who received many and great favours at the hand of Antony, but afterwards went over to Augustus. The people were called *Abretteni*; inhabiting the country between Ancyra of Phrygia and the river Rhindacus.

ABRIDGEMENT, in *Literature*, a term signifying the reduction of a book into a smaller compass.

The art of conveying much sentiment in few words, is the happiest talent an author can be possessed of. This talent is peculiarly necessary in the present state of literature; for many writers have acquired the dexterity of spreading a few trivial thoughts over several hundred pages. When an author hits upon a thought that pleases him, he is apt to dwell upon it, to view it in different lights, to force it in improperly, or upon the slightest relations. Though this may be pleasant to the writer, it tires and vexes the reader. There is another great source of diffusion in composition. It is a capital object with an author, whatever be the subject, to give vent to all his best thoughts. When he finds a proper place for any of them, he is peculiarly happy. But rather than sacrifice a thought he is fond of, he forces it in by way of digression, or superfluous illustration.

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illustration. If none of these expedients answer his purpose, he has recourse to the margin, a very convenient apartment for all manner of pedantry and impertinence. There is not an author, however correct, but is more or less faulty in this respect. An abridger, however, is not subject to these temptations. The thoughts are not his own; he views them in a cooler and less affectionate manner; he discovers an impropriety in some, a vanity in others, and a want of utility in many. His business, therefore, is to retrench superfluities, digressions, quotations, pedantry, &c. and to lay before the public only what is really useful. This is by no means an easy employment: To abridge some books, requires talents equal, if not superior, to those of the author. The facts, manner, spirit, and reasoning must be preserved; nothing essential, either in argument or illustration, ought to be omitted. The difficulty of the task is the principal reason why we have so few good abridgments: Wynne's abridgement of Locke's Essay on the Human Understanding, is perhaps the only unexceptionable one in our language.

These observations relate solely to such abridgements as are designed for the public. But,

When a person wants to set down the substance of any book, a shorter and less laborious method may be followed. It would be foreign to our plan to give examples of abridgements for the public: But as it may be useful, especially to young people, to know how to abridge books for their own use, after giving a few directions, we shall exhibit an example or two, to show with what ease it may be done.

Read the book carefully; endeavour to learn the principal view of the author; attend to the arguments employed: When you have done so, you will generally find, that what the author uses as new or additional arguments, are in reality only collateral ones, or extensions of the principal argument. Take a piece of paper or a common-place book, put down what the author wants to prove, subjoin the argument or arguments, and you have the substance of the book in a few lines. For example,

In the Essay on Miracles, Mr Hume's design is to prove, That miracles which have not been the immediate objects of our senses, cannot reasonably be believed upon the testimony of others.

Now, this argument (for there happens to be but one) is,

"That experience, which in some things is variable, in others uniform, is our *only* guide in reasoning concerning matters of fact. A variable experience gives rise to probability only; an uniform experience amounts to a proof. Our belief of any fact from the testimony of eye witnesses is derived from no other principle than our experience in the veracity of human testimony. If the fact attested be miraculous, here arises a contest of two opposite experiences, or proof against proof. Now, a miracle is a violation of the laws of nature; and as a firm and unalterable experience has established these laws, the proof against a miracle, from the very nature of the fact, is as complete as any argument from experience can possibly be imagined; and if so, it is an undeniable consequence, that it cannot be surmounted by any proof whatever derived from human testimony."

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In Dr Campbell's Dissertation on Miracles, the author's principal aim is to show the fallacy of Mr Hume's argument; which he has done most successfully by another single argument, as follows:

"The evidence arising from human testimony is *not* solely derived from experience: on the contrary, testimony hath a natural influence on belief antecedent to experience. The early and unlimited assent given to testimony by children gradually contracts as they advance in life: it is, therefore, more consonant to truth to say, that our *diffidence* in testimony is the result of experience, than that our *faith* in it has this foundation. Besides, the uniformity of experience, in favour of any fact, is not a proof against its being reversed in a particular instance. The evidence arising from the single testimony of a man of known veracity will go farther to establish a belief in its being actually reversed: If his testimony be confirmed by a few others of the same character, we cannot withhold our assent to the truth of it. Now, though the operations of nature are governed by uniform laws, and though we have not the testimony of our senses in favour of any *violation* of them; still, if in particular instances we have the testimony of *thousands* of our fellow-creatures, and those too men of strict integrity, swayed by no motives of ambition or interest, and governed by the principles of common sense, That they were actually eye witnesses of these violations, the constitution of our nature obliges us to believe them."

These two examples contain the substance of about 400 pages.—Making private abridgements of this kind has many advantages: It engages us to read with accuracy and attention; it fixes the subject in our minds; and, if we should happen to forget, instead of reading the books again, by glancing a few lines, we are not only in possession of the chief arguments, but recal in a good measure the author's method and manner.

Abridging is peculiarly useful in taking the substance of what is delivered by professors, &c. It is impossible, even with the assistance of short-hand, to take down, *verbatim*, what is said by a public speaker. Besides, although it were practicable, such a talent would be of little use. Every public speaker has circumlocutions, redundancies, lumber which deserve not to be copied. All that is really useful may be comprehended in a short compass. If the plan of the discourse, and arguments employed in support of the different branches, be taken down, you have the whole. These you may afterwards extend in the form of a discourse dressed in your own language. This would not only be a more rational employment, but would likewise be an excellent method of improving young men in composition; an object too little attended to in all our universities.

"The mode of reducing, says the author of the *Cu-riositys of Literature*, what the ancients had written in bulky volumes, practised in preceding centuries, came into general use about the fifth. As the number of students and readers diminished, authors neglected literature, and were disgusted with composition; for to write is seldom done, but when the writer entertains the hope of finding readers. Instead of original authors, there suddenly arose numbers of *abridgers*. These men, amidst the prevailing disgust

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for literature, imagined they should gratify the public by introducing a mode of reading works in a few hours, which otherwise could not be done in many months; and, observing that the bulky volumes of the ancients lay buried in dust, without any one condescending to examine them, the disagreeable necessity inspired them with an invention that might bring those works and themselves into public notice, by the care they took of renovating them. This they imagined to effect by forming abridgements of these ponderous volumes.

All these Abridgers, however, did not follow the same mode. Some contented themselves with making a mere abridgement of their authors, by employing their own expressions, or by inconsiderable alterations. Others composed those abridgements in drawing them from various authors, but from whose works they only took what appeared to them most worthy of observation, and dressed them in their own style. Others, again, having before them several authors who wrote on the same subject, took passages from each, united them, and thus formed a new work. They executed their design by digesting in common places, and under various titles, the most valuable parts they could collect, from the best authors they read. To these last ingenious scholars, we owe the rescue of many valuable fragments of antiquity. They happily preserved the best maxims, the characters of persons, descriptions, and any other subjects which they found interesting in their studies.

There have been learned men who have censured these Abridgers, as the cause of our having lost so many excellent entire works of the ancients; for posterity becoming less studious, was satisfied with these extracts, and neglected to preserve the originals, whose voluminous size was less attractive. Others on the contrary say, that these Abridgers have not been so prejudicial to literature, as some have imagined; and that had it not been for their care, which snatched many a perishable fragment from that shipwreck of letters, which the barbarians occasioned, we should perhaps have had no works of the ancients remaining.

Abridgers, Compilers, and even Translators, in the present fastidious age, are alike regarded with contempt; yet to form their works with skill requires an exertion of judgment, and frequently of taste, of which their contemners appear to have no conception. It is the great misfortune of such literary labours, that even when performed with ability, the learned will not be found to want them, and the unlearned have not discernment to appreciate them."

ABRINCATARUM OPPIDUM, in *Ancient Geography*, the town of the *Abrincates* or *Abrincatui*; now *Avanches*, in France, situated on an eminence in the south-west of Normandy, near the borders of Brittany, on the English channel. W. Long. 1. 10. N. Lat. 48. 40.

ABROGATION, the act of abolishing a law, by authority of the maker; in which sense the word is synonymous with abolition, repealing, and revocation.

Abrogation stands opposed to *rogation*: it is distinguished from *derogation*, which implies the taking away only some part of a law; from *subrogation*, which denotes the adding a clause to it; from *obrogation*, which implies the limiting or restraining it; from *dispensation*, which only sets it aside in a particular in-

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stance; and from *antiquation*, which is the refusing to pass a law.

ABROKANI, or **MALLEMOLLI**, a kind of muslin, or clear, white, fine cotton cloth, brought from the East Indies, particularly from Bengal; being in length 16 French ells and 3 quarters, and in breadth 5 eighths.

ABROLHOS, in *Geography*, dangerous shoals or banks of sand, about 20 leagues from the coast of Brazil. S. Lat. 18. 22. W. Long. 38. 45.

ABROMA, in *Botany*. See *BOTANY INDEX*.

ABROTANUM, in *Botany*. See *ARTEMISIA*, *BOTANY INDEX*.

ABROTONUM, in *Ancient Geography*, a town and harbour on the Mediterranean, in the district of Syrtis Parva in Africa; one of the three cities that formed Tripoly.

ABRUG-BANXA, in *Geography*, a populous town of Transylvania, in the district of Weissenburg. It is situated in a country which abounds with mines of gold and silver, and is the residence of the mine office, and chief of the metal towns. E. Long. 23. 24. N. Lat. 46. 50.

ABRUS, in *Botany*, the trivial name of the *GLYCINE*.

ABRUZZO, a province of Naples. The river Pescara divides it into two parts; one of which is called *Uterior*, of which *Aquila* is the capital; and the other *Citerior*, whose capital is *Chieti*. Besides the Apennines, there are two considerable mountains, the one called *Monte Cavallo*, and the other *Monte Majello*; the top of which last is always covered with snow. *Abruzzo* is a cold country; but the rigour of the climate is not so great as to prevent the country from producing in abundance every thing requisite for the support of life. Vegetables, fruits, animals, and numberless other articles of sustenance, not only furnish ample provision for the use of the natives, but also allow of exportation. It produces so much wheat, that many thousands of quarters are annually shipped off. Much Turkey wheat is sent out, and the province of Teramo sells a great deal of rice little inferior in quality to that of Lombardy. Oil is a plentiful commodity, and wines are made for exportation on many parts of the coast; but wool has always been, and still is, their staple commodity: the flocks, after passing the whole summer in the fine pastures of the mountains, are driven for the winter into the warm plains of Puglia, and a few spots near their own coast, where the snow does not lie. There are no manufactures of woollens in the province, except two small ones of coarse cloth. The greatest part of the wool is exported unwrought. No silk is made here, though mulberry trees would grow well in the low grounds.

Formerly the territory of *Aquila* furnished Italy almost exclusively with saffron; but since the culture of that plant has been so much followed in Lombardy, it has fallen to nothing in *Abruzzo*. In the maritime tracts of country the cultivation of liquorice has been increased of late years, but foreigners export the roots in their natural state: in the province of Teramo there is a manufactory of pottery ware, for which there is a great demand in Germany, by the way of Trieste, as it is remarkably hard and fine; but even this is going

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Abruzzo. to decay, by being abandoned entirely to the ignorance of common workmen. It is not to be expected that any improvements will be made in arts and manufactures, where the encouragement and attention of superiors is wanting, and no pains taken to render the commodity more marketable, or to open better channels of sale for it. The only advantages these provinces enjoy, are the gift of benevolent nature; but she has still greater presents in store for them, and waits only for the helping hand of government to produce them. This whole coast, one hundred miles in length, is utterly destitute of sea ports; and the only spots where the produce can be embarked are dangerous inconvenient roads, at the mouths of rivers, and along a lee-shore: the difficulty of procuring shipping, and of loading the goods, frequently causes great quantities of them to rot on hand; which damps industry, and prevents all improvements in agriculture. The husbandman is a poor dispirited wretch, and wretchedness produces emigration: the uneven surface of the country occasions it to be inhabited by retail, if the expression may be used, rather than in large masses; for there is not a city that contains ten thousand people, and few of them exceed three thousand. Villages, castles, and feudatory estates are to be met with in abundance; but the numbers of their inhabitants are to be reckoned by hundreds, not thousands: in a word, the political and social system of the province shows no signs of the vigour which nature so remarkably displays here in all her operations.

The antiquary and the naturalist may travel here with exquisite pleasure and profit; the former will find treasures of inscriptions, and inedited monuments, belonging to the warlike nations that once covered the face of the country; the natural philosopher will have a noble field for observation in the stupendous mountains that rise on all sides. Monte-corno and Majello are among the most interesting. The first is like an aged monument of nature, bald, and horribly broken on every aspect; from various appearances, it is evident that its bowels contain many valuable veins of metallic ore; but the great difficulty of access renders the search of them almost impracticable. Majello has other merits, and of a gayer kind:—nature has clothed its declivities and elevated fields with an infinite variety of plants.

The character of the inhabitants varies a little among themselves, according to situation and climate, but essentially from the disposition of the natives of the more southern provinces. This proceeds from a difference of origin: for the Lombards, who were barbarians, but not cruel; poor, but hospitable; endowed with plain honest sense, though possessed of little acuteness or subtlety; remained peaceable proprietors of these mountainous regions, till the Normans, who were accustomed to a similar climate, came and dispossessed them. The Greeks who retained almost every other part of the kingdom under their dominion, never had any sway here. For this reason the Abruzzesi still bear a great resemblance to their northern progenitors or masters: to this day one may trace in them the same goodness of heart, but great indolence and repugnance to lively exertions; a fault that proceeds rather from a want of active virtue, than a disposition to wickedness. Hence it comes, that in these provinces, where the proximity of the frontier almost ensures im-

punity, fewer atrocious and inhuman deeds are heard of than in other parts of the realm. Remnants of ancient northern customs existed here so late as the beginning of this century, and, among the mountaineers, very evident traces of the Frank and Teutonic languages may be discovered.

ABSALOM, in *Scripture History*, the son of David by Maacah, was brother to Tamar, David's daughter, who was ravished by Amnon their eldest brother by another mother. Absalom waited two years for an opportunity of revenging the injury done to his sister: and at last procured the assassination of Amnon at a feast which he had prepared for the king's sons. He took refuge with Talmai king of Geshur; and was no sooner restored to favour, but he engaged the Israelites to revolt from his father. Absalom was defeated in the wood of Ephraim: as he was flying, his hair caught hold of an oak, where he hung till Joab came and thrust him through with three darts: David had expressly ordered his life to be spared, and extremely lamented him. The weight of Absalom's hair, which is stated at "200 shekels after the king's weight," has occasioned much critical discussion. If, according to some, the Jewish shekel of silver was equal to half an ounce avoirdupois, 200 shekels would be $6\frac{1}{2}$ pounds; or, according to Josephus, if the 200 shekels be equal to 5 minæ, and each mina $2\frac{1}{2}$ pounds, the weight of the hair would be $12\frac{1}{2}$ pounds, a supposition not very credible. It has been supposed by others, that the shekel here denotes a weight in gold equal to the value of the silver shekel, or half an ounce, which will reduce the weight of the hair to about 5 ounces; or that the 200 shekels are meant to express the value, not the weight.

ABSCISS, in *Surgery*; from *abscedo*, to separate; a cavity containing pus; or a collection of puriform matter in a part: So called, because the parts which were joined are now separated; one part recedes from another, to make way for the collected matter. See **SURGERY**.

ABSCISSE, in *Conics*, a part of the diameter or transverse axis of a conic section, intercepted between the vertex or some other fixed point and a semiordinate. See **CONIC SECTIONS**.

ABSCONSA, a dark lantern used by the monks at the ceremony of burying their dead.

ABSENCE, in *Scots Law*: When a person cited before a court does not appear, and judgment is pronounced, that judgment is said to be *in absence*. No person can be tried criminally in absence.

ABSENTEE, a person absent from his station, employment, or country. See **SUPPLEMENT**.

ABSIMARUS, in *History*, having dethroned Leontius, cut off his nose and ears, and shut him up in a monastery, was proclaimed by the soldiers emperor of the East, A. D. 698. Leontius himself was also an usurper. He had dethroned Justinian II. who, afterwards, with the assistance of the Bulgarians, surprised and took Constantinople and made Absimarus prisoner. Justinian, now settled on the throne, and having both Absimarus and Leontius in his power, loaded them with chains, ordered them to lie down on the ground, and with a barbarous pleasure, held a foot on the neck of each for the space of an hour in presence of the people, who with shouts and exclamations sung, *Super aspi-*
dem

Abruzzo
||
Absimar

Absimar *dem et basiliscum ambulabis, et conculcabis leonem et draconem.* "Thou shalt walk on the asp and the basilisk, and tread on the lion and the dragon." By the orders of Justinian, Absimar and Leontius were beheaded, A. D. 705.

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Absolute.

ABSINTHIATED, any thing tinged or impregnated with absinthium or wormwood. Bartholin mentions a woman whose milk was become absinthiated, and rendered as bitter as gall, by the too liberal use of wormwood.

Vinum absinthites, or *poculum absinthiatum*, "wormwood wine," is much spoken of among the ancients as a wholesome drink, and even an antidote against drunkenness. Its medical virtues depend on its aromatic and bitter qualities. Infused in wine or spirits, it may prove beneficial in cases of indigestion or debility of the stomach.

ABSINTHIUM, in *Botany*, the trivial name of the common wormwood. See **ARTEMISIA**, **BOTANY Index**.

ABSIS, in *Astronomy*, the same with *apsis*. See **APSIS**.

ABSOLUTE, in a general sense, something that stands free or independent.

ABSOLUTE is more particularly understood of a being or thing which does not proceed from any cause, or does not subsist by virtue of any other being, considered as its cause; in which sense, God alone is *absolute*. *Absolute*, in this sense, is synonymous with *independent*, and stands opposed to *dependent*.

ABSOLUTE also denotes a thing that is free from conditions or limitations; in which sense, the word is synonymous with *unconditional*. We say, an *absolute* decree, *absolute* promise, *absolute* obedience.

ABSOLUTE Government, that in which the prince is left solely to his own will, being not limited to the observance of any laws except those of his own discretion.

ABSOLUTE Equations, in *Astronomy*, is the aggregate of the optic and eccentric equations. The apparent inequality of a planet's motion, arising from its not being equally distant from the earth at all times, is called its optic equation, and would subsist even if the planet's real motion were uniform. The eccentric inequality is caused by the planet's motion being uniform. To illustrate which, conceive the sun to move, or to appear to move, in the circumference of a circle, in whose centre the earth is placed. It is manifest, that if the sun moves uniformly in this circle, it must appear to move uniformly to a spectator on the earth, and in this case there will be no optic nor eccentric equation; but suppose the earth to be placed out of the centre of the circle, and then, though the sun's motion should be really uniform, it would not appear to be so, when seen from the earth; and in this case there would be an optic equation, without an eccentric one. Imagine farther, the sun's orbit to be not circular but elliptic, and the earth in its focus; it will be as evident that the sun cannot appear to have an uniform motion in such ellipse: so that his motion will then be subject to two equations, the optic and the eccentric.

ABSOLUTE Number, in *Algebra*, is any pure number standing in any equation without the conjunction of literal characters; as $2x + 36 = 48$; where 36 and 48

are absolute numbers, but 2 is not, as being joined with the letter *x*.

ABSOLUTION, in *Civil Law*, is a sentence whereby the party accused is declared innocent of the crime laid to his charge.—Among the Romans, the ordinary method of pronouncing judgment was this: after the cause had been pleaded on both sides, the prætor used the word *dixerunt*, q. d. they have said what they had to say; then three ballots were distributed to each judge, marked as mentioned under the article **A**; and as the majority fell of either mark, the accused was *absolved* or condemned, &c. If he were absolved, the prætor dismissed him with *videtur non fecisse*, or *jure videtur fecisse*.

ABSOLUTION, in the *Canon Law*, is a juridical act, whereby the priest declares the sins of such as are penitent remitted.—The Romanists hold absolution a part of the sacrament of penance; the council of Trent, sess. xiv. cap. iii. and that of Florence, in the decree *ad Armenos*, declare the form or essence of the sacrament to lie in the words of *absolution*, I absolve thee of thy sins. The *formula* of absolution, in the Romish church, is *absolute*: in the Greek church, it is deprecatory; and in the churches of the reformed, declarative.

ABSOLUTION is chiefly used among Protestants for a sentence by which a person who stands excommunicated is released or freed from that punishment.

ABSORBENT, in general, any thing possessing the faculty of *absorbing*, or swallowing up another.

ABSORBENT Medicines, testaceous powders, or substances into which calcareous earth enters, as chalk, crabs eyes, &c. which are taken inwardly, for drying up or absorbing any acid or redundant humours in the stomach or intestines. They are likewise applied externally to ulcers or sores with the same intention.

ABSORBENTS, or **ABSORBING Vessels**, in *Anatomy*, a name given promiscuously to the lacteal vessels, lymphatics, and inhalant arteries, a minute kind of vessels found in animal bodies, which imbibe fluids that come in contact with them. On account of their minuteness and transparency, they escape observation in ordinary dissection. They have, however, been detected in every tribe of animals, and, in the animals which have been examined, in every part of the body. Those which open into the stomach and intestines, and convey the chyle, which is a milky fluid, from these organs to the blood, have received the name of *lacteals*, or lacteal vessels; and those which open on the external surface, and the surface of all the cavities of the body, have been denominated *lymphatics*, from the lymph or colourless fluid which they contain. See **ANATOMY**.

ABSORBING, the swallowing up, sucking up, or imbibing any thing: thus black bodies are said to *absorb* the rays of light; luxuriant branches, to *absorb*, or waste the nutritious juices which should feed the fruit of trees, &c.

ABSORPTION, in the animal economy, is the function of the absorbent vessels, or that power by which they take up and propel substances. This power has been ascribed to the operation of different causes, according to the theories which physiologists have proposed. Some attribute it to capillary attraction, others to the pressure of the atmosphere, and others to

Absorption
||
Abstemi-
ous.

an ambiguous or unknown cause, which they denominated *suction*; for this last is nothing else than the elastic power of one part of the air restoring the equilibrium, which has been destroyed by the removal or rarefaction of another part.

ABSORPTIONS of the Earth, a term used by Kircher and others for the sinking in of large tracts of land by means of subterranean commotions, and many other accidents.

Pliny tells us, that in his time the mountain Cymbotus, with the town of Carites, which stood on its side, were wholly absorbed into the earth, so that not the least trace of either remained; and he records the like fate of the city of Tantalus in Magnesia, and after it of the mountain Sypilus, both thus absorbed by a violent opening of the earth. Galamis and Gamales, towns once famous in Phœnicia, are recorded to have met the same fate; and the vast promontory, called *Phegium*, in Ethiopia, after a violent earthquake in the night-time, was not to be seen in the morning, the whole having disappeared, and the earth closed over it. These and many other histories, attested by the authors of greatest credit among the ancients, abundantly prove the fact in the earlier ages; and there have not been wanting too many instances of more modern date. (*Kircher's Mund. Subter.* p. 77.)

Picus, a lofty mountain in one of the Molucca isles, which was seen at a great distance, and served as a land-mark to sailors, was entirely destroyed by an earthquake; and its place is now occupied by a lake, the shores of which correspond exactly to the base of the mountain. In 1556, a similar accident happened in China. A whole province of the mountainous part of the country, with all the inhabitants, sunk in a moment, and was totally swallowed up: The space which was formerly land was also covered with an extensive lake of water. And, during the earthquakes which prevailed in the kingdom of Chili, in the year 1646, several whole mountains of the Andes sunk and disappeared.

ABSORUS, *APSORUS*, *ABSYRTIS*, *ABSYRTIDES*, *APSYRTIDES*, *APSYRTIS*, and *ABSYRTIUM*, (Strabo, Mela, Ptolemy); islands in the Adriatic, in the gulf of Carnero; so called from Absyrtus, Medea's brother, there slain. They are either one island, or two separated by a narrow channel, and joined by a bridge; and are now called *Cherso* and *Osero*.

ABSTEINEN, in *Geography*, a district near the river Memel in Little Lithuania. It is a mountainous country, but is fertile in grain, and abounds with sheep and excellent horses.

ABSTEMII, in church history, a name given to such persons as could not partake of the cup of the eucharist on account of their natural aversion to wine. Calvinists allow these to communicate in the species or bread only, touching the cup with their lip; which, on the other hand, is by the Lutherans deemed a profanation.

ABSTEMIOUS, is properly understood of a person who refrains absolutely from all use of wine.

The history of Mr Wood, in the *Medic. Trans.* vol. ii. p. 261, art. 18. is a very remarkable exemplification of the very beneficial alterations which may be effected on the human body by a strict course of abstemiousness.

The Roman ladies, in the first ages of the republic, were all enjoined to be abstemious; and that it might appear, by their breath, whether or no they kept up to the injunction, it was one of the laws of the Roman civility, that they should kiss their friends and relations whenever they accosted them.

ABSTEMIUS, *LAURENTIUS*, a native of Macerata, professor of belles lettres in Urbino, and librarian of Duke Guido Ubaldo, under the pontificate of Alexander VI. He wrote, 1. Notes on most difficult passages of ancient authors. 2. *Hecatomythium*, i. e. A collection of an hundred fables, &c. which have been often printed with those of Æsop, Phædrus, Gabrius, Avienus, &c. and a preface to the edition of Aurelius Victor published at Venice in 1505.

ABSTERGENT MEDICINES, those employed for resolving obstructions, concretions, &c. such as soap, &c.

ABSTINENCE, in a general sense, the act or habit of refraining from something to which there is a strong propensity. Among the Jews, various kinds of abstinence were ordained by their law. The Pythagoreans, when initiated, were enjoined to abstain from animal food, except the remains of sacrifices; and to drink nothing but water, unless in the evening, when they were permitted to take a small portion of wine. Among the primitive Christians, some denied themselves the use of such meats as were prohibited by that law, others regarded this abstinence with contempt; of which St Paul gives his opinion, Rom. xiv. 1—3. The council of Jerusalem, which was held by the apostles, enjoined the Christian converts to abstain from meats strangled, from blood, from fornication, and from idolatry. Abstinence, as prescribed by the gospel, is intended to mortify and restrain the passions, to humble our vicious natures, and by that means raise our minds to a due sense of devotion. But there is another sort of abstinence, which may be called *ritual*, and consists in abstaining from particular meats at certain times and seasons. It was the spiritual monarchy of the western world which first introduced this ritual abstinence; the rules of which were called *rogations*; but grossly abused from the true nature and design of fasting. In England, abstinence from flesh has been enjoined by statute since the Reformation, particularly on Fridays and Saturdays, on vigils, and on all commonly called *fish days*. The like injunctions were renewed under Queen Elizabeth: but at the same time it was declared, that this was done not out of motives of religion, as if there were any difference in meats; but in favour of the consumption of fish, and to multiply the number of fishermen and mariners, as well as to spare the stock of sheep. The great fast, says St Augustin, is to abstain from sin.

ABSTINENCE is more particularly used for a spare diet, or a slender parsimonious use of food. Physicians relate wonders of the effects of abstinence in the cure of many disorders, and protracting the term of life. The noble Venetian Cornaro, after all imaginable means had proved vain, so that his life was despaired of at 40, recovered, and lived to near 100, by the mere effect of abstinence; as he himself gives the account. It is indeed surprising to what a great age the primitive Christians of the east, who retired from the persecutions into the deserts of Arabia and Egypt, lived,

Abstinence. ved, healthful and cheerful, on a very little food. Cassian assures us, that the common rate for 24 hours was 12 ounces of bread, and pure water: with such frugal fare St Anthony lived 105 years; James the Hermit, 104; Arsenius, tutor of the emperor Arcadius, 120; St Epiphanius, 115; Simeon the Stylite, 112; and Romauld, 120. Indeed, we can match these instances of longevity at home. Buchanan informs us, that one Laurence arrived at the great age of 140 by force of temperance and labour; and Spotswood mentions one Kentigern, afterwards called St Mongah or Mungo, who lived to 185 by the same means. Abstinence, however, is to be recommended only as it means a proper regimen; for in general it must have bad consequences when observed without a due regard to constitution, age, strength, &c. According to Dr Cheyne, most of the chronical diseases, the infirmities of old age, and the short lives of Englishmen, are owing to repletion; and may be either cured, prevented, or remedied by abstinence; but then the kinds of abstinence which ought to be observed, either in sickness or health, are to be deduced from the laws of diet and regimen.

Among the inferior animals, we see extraordinary instances of long abstinence. The serpent kind, in particular, bear abstinence to a wonderful degree. We have seen rattle-snakes which had lived many months without any food, yet still retained their vigour and fierceness. Dr Shaw speaks of a couple of cerastes (a sort of Egyptian serpents), which had been kept five years in a bottle close corked, without any sort of food, unless a small quantity of sand in which they coiled themselves up in the bottom of the vessel may be reckoned as such: yet when he saw them, they had newly cast their skins, and were as brisk and lively as if just taken. But it is natural for divers species to pass four, five, or six months every year, without either eating or drinking. Accordingly, the tortoise, bear, dormouse, serpent, &c. are observed regularly to retire, at those seasons, to their respective cells, and hide themselves, some in the caverns of rocks or ruins; others dig holes under ground; others get into woods, and lay themselves up in the clefts of trees; others bury themselves under water, &c. And these animals are found as flat and fleshy, after some months abstinence, as before.—Sir G. Ent* weighed his tortoise several years successively, at its going to earth in October, and coming out again in March; and found, that of four pounds four ounces, it only used to lose about one ounce. Indeed we have instances of men passing several months as strictly abstinent as other creatures. In particular, the records of the Tower mention a Scotchman imprisoned for felony, and strictly watched in that fortress for six weeks, during which time he did not take the least sustenance: and on this account he obtained his pardon. Numberless instances of extraordinary abstinence, particularly from morbid causes, are to be found in the different periodical Memoirs, Transactions, Ephemerides, &c. It is to be added, that, in most instances of extraordinary human abstinence related by naturalists, there were said to have been apparent marks of a texture of blood and humours, much like that of the animals above mentioned. Though it is no improbable opinion, that the air itself may furnish something for nutrition, it is certain, there are sub-

stances of all kinds, animal, vegetable, &c. floating in the atmosphere, which must be continually taken in by respiration; and that an animal body may be nourished thereby, is evident in the instance of vipers; which if taken when first brought forth, and kept from every thing but air, will yet grow very considerably in a few days. So the eggs of lizards are observed to increase in bulk, after they are produced, and in like manner the eggs or spawn of fishes grow and are nourished with the water. And hence, say some, it is that cooks, turnspit dogs, &c. though they eat but little, yet are usually fat. See **FASTING**. See also **DIETETICS**, **SUPPLEMENT**.

ABSTINENTS, or **ABSTINENTES**, a set of heretics that appeared in France and Spain about the end of the third century. They are supposed to have borrowed part of their opinions from the Gnostics and Manicheans, because they opposed marriage, condemned the use of flesh meat, and placed the Holy Ghost in the class of created beings. We have, however, no certain account of their peculiar tenets.

ABSTRACT, in a general sense, any thing separated from something else.

ABSTRACT Idea, in *Metaphysics*, is a partial idea of a complex object, limited to one or more of the component parts or properties, laying aside or abstracting from the rest. Thus, in viewing an object with the eye, or recollecting it in the mind, we can easily abstract from some of its parts or properties, and attach ourselves to others: we can attend to the redness of a cherry, without regard to its figure, taste, or consistence. See **ABSTRACTION**.

ABSTRACT Mathematics, otherwise called *Pure Mathematics*, is that which treats of magnitude or quantity, absolutely and generally considered, without restriction to any species of particular magnitude; such are Arithmetic and Geometry. In this sense, abstract mathematics is opposed to mixed mathematics; wherein simple and abstract properties, and the relations of quantities primitively considered in pure mathematics, are applied to sensible objects, and by that means become intermixed with physical considerations: such are Hydrostatics, Optics, Navigation, &c.

ABSTRACT Numbers, are assemblages of units, considered in themselves, without denoting any particular and determinate things. Thus six is an abstract number, when not applied to any thing; but if we say 6 feet, 6 becomes a concrete number. See the article **NUMBER**.

ABSTRACT Terms, words that are used to express abstract ideas. Thus *beauty, ugliness, whiteness, roundness, life, death*, are abstract terms.

ABSTRACT, in *Literature*, a compendious view of any large work; shorter and more superficial than an abridgement.

ABSTRACTION, in general, the art of abstracting, or the state of being abstracted.

ABSTRACTION, in *Metaphysics*, the operation of the mind when occupied by abstract ideas. A large oak fixes our attention, and abstracts us from the shrubs that surround it. In the same manner, a beautiful woman in a crowd, abstracts our thoughts, and engrosses our attention solely to herself. These are examples of real abstraction: when these, or any others of a similar kind, are recalled to the mind after the objects themselves.

* Phil.
Trans.
N^o 194.

Abstrac-
tion
||
Absyrtus.

themselves are removed from our sight, they form what are called *abstract ideas*, or the mind is said to be employed in abstract ideas. But the power of abstraction is not confined to objects that are separable in reality as well as mentally: the size, the figure, the colour of a tree, are inseparably connected, and cannot exist independent of each other; and yet we can mentally confine our observations to any one of these properties, neglecting or abstracting from the rest.

Abstraction is chiefly employed these three ways. First, When the mind considers any one part of a thing, in some respect distinct from the whole; as a man's arm, without the consideration of the rest of the body. Secondly, When we consider the *mode* of any substance, omitting the substance itself; or when we separately consider several modes which subsist together in one subject. This abstraction the geometricians make use of when they consider the length of a body separately, which they call a *line*, omitting the consideration of its breadth and thickness. Thirdly, It is by abstraction that the mind forms general or universal ideas: omitting the modes and relations of the particular objects whence they are formed. Thus, when we would understand a thinking being in general, we gather from our self-consciousness what it is to think; and omitting those things which have a particular relation to our own minds, or to the human mind, we conceive a thinking being in general.

Ideas formed in this manner, which are what we properly call *abstract ideas*, become general representatives of all objects of the same kind; and their names applicable to whatever exists conformable to such ideas. Thus the idea of colour that we receive from chalk, snow, milk, &c. is a representative of all of that kind; and has a name given it, *whiteness*, which signifies the same quality wherever found or imagined.

ABSTRUSE, something deep, hidden, concealed, or far removed from common apprehensions, and therefore not easily understood; in opposition to what is obvious and palpable. Thus metaphysics is an abstruse science; and the doctrine of fluxions, and the method *de maximis et minimis*, are abstruse points of knowledge.

ABSURD, an epithet applied to any thing that is contrary to human apprehension, and contradicts a manifest truth. Thus, it would be absurd to say that 6 and 6 make only 10, or to deny that twice 6 make 12. When the term *absurd* is applied to actions, it has the same import as *ridiculous*.

ABSURDUM, *reductio ad absurdum*, is a mode of demonstration employed by mathematicians when they prove the truth of a proposition by demonstrating that the contrary is impossible, or leads to an absurdity. It is in this manner that Euclid demonstrates the fourth proposition of the first book of the Elements, by showing that the contrary involves a manifest absurdity, viz. "*That two straight lines can inclose a space.*"

ABSINTHIUM. See ARTEMISIA, BOTANY *Indea*.

ABSYRTUS, in heathen mythology, the son of Ætes and Hypsea, and the brother of Medea. The latter running away with Jason, after her having assisted him in carrying off the golden fleece, was pursued by her father; when, to stop his progress, she tore Absyrtus in pieces, and scattered his limbs in his way.

ABTHANES, in *History*, a title of honour used by the ancient inhabitants of Scotland, who called their nobles *thanes*, which in the old Saxon signifies *king's ministers*; and of these the higher rank were styled *abthanes*, and those of the lower *underthanes*. Abthancæ,
Abubeker.

ABUBEKER, or ABU-BEER, the first caliph, the immediate successor of Mahomet, and one of his first converts. His original name was Abduleaaba, signifying, *servant of the caaba or temple*, which, after his conversion to Mahometanism, was changed to Abdallah, *servant of God*; and on the marriage of the prophet with his daughter Ayesha, he received the appellation of Abu-Beer, *Father of the virgin*. Illustrious by his family, and possessed of immense wealth, his influence and example were powerful means of propagating the faith he had adopted, and in gaining converts to the new religion. Abubeker was a sound believer, and although he lived in the greatest familiarity with Mahomet, he had always the highest veneration for his character. He vouched for the truth of his revelations after his nightly visits to heaven, and thus obtained the appellation of the *faithful*. He was employed in every mission of trust or importance, was the constant friend of the prophet, and when he was forced to fly from Mecca, was his only companion. But notwithstanding his blind devotion to Mahometanism, his moderation and prudence were conspicuous in checking the fanatical zeal of the disciples of the new religion, on the death of Mahomet. This event threatened destruction to the doctrines of Islamism. Its followers could not doubt that it had taken place, and they were afraid to believe it. In this uncertainty and fluctuation of belief, Omar drew his sword, and threatened to cut in pieces all who dared to assert that the prophet was dead. Abubeker, with more coolness and wisdom, addressed the people. *Is it, says he, Mahomet whom you adore, or the God whom he has revealed to you? Know that this God is alone immortal, and that all those whom he has created are subject to death.* Appeased and reconciled by this speech, they elected him successor to Mahomet, and he assumed the modest title of caliph, which has continued with all his successors. Ali, the son-in-law of the prophet, regarding the elevation of Abubeker as a violation of his legal rights to the succession, refused at first to recognise the appointment, till he was forced by threats into compliance and submission. His partisans, however, still considered him as the legitimate successor, and their opinion has prevailed among many Mussulmans, who believe that the sovereign authority, both spiritual and temporal, remains with his descendants.

The first part of the reign of Abubeker was unsettled and turbulent. Many of his subjects returned to idolatry, some embraced Christianity, new impostors arose. Seduced by the example of Mahomet, they were dazzled with the hope of power and distinction, and were thus led on to destruction. He alone was received as the true prophet, all others were false. Abubeker, with the assistance of Caled, an able general, soon reduced to submission and obedience, or punished with death, all those who disputed or resisted his authority. Tranquillity being established at home, he sent out his armies, under the same general, to propagate the Mahometan faith in Syria, which, after a bloody battle, was compelled to submit to a new power, and to adopt a new religion. Damascus was afterwards besieged; and

Abubeker and on the very day that it surrendered and opened its gates to his victorious arms, Abubeker expired in the 13th year of the Hegira.

The public conduct of this caliph was marked by prudence, equity, and moderation. Mild and simple in his manners, frugal in his fare, he discovered great indifference to riches and honours. Such was his liberality to the poor and to his soldiers, that he bestowed on them the whole of his revenue. The treasury being on this account quite exhausted at his death, made Omar say, "that he had left a difficult example for his successors to follow." A short time before his death, he dictated his will in the following words: "This is the will of Abubeker, which he dictated at the moment of his departure from this world: At this moment when the infidel shall believe, when the impious shall no longer doubt, and liars shall speak truth, I name Omar for my successor. Mussulmans, hear his voice, and obey his commands. If he rule justly, he will confirm the good opinion which I have conceived of him; but if he deviate from the paths of equity, he must render an account before the tribunal of the sovereign judge. My thoughts are upright, but I cannot see into futurity. In a word, they who do evil, shall not always escape with impunity." Abubeker first collected and digested the revelations of Mahomet, which had hitherto been preserved in detached fragments, or in the memories of the believers; and to this the Arabians gave the appellation *Almoshaf*, or the Book. The first copy was deposited in the hands of Hafessa, the daughter of Omar and the widow of Mahomet.

ABUCCO, ABOCO, or ABOCHI, a weight used in the kingdom of Pegu. One abucco contains $12\frac{1}{2}$ teccalis; two abuccos make a *giro* or *agire*; two *giri*, half a *hiza*; and a *hiza* weighs an hundred teccalis; that is, two pounds five ounces the heavy weight, or three pounds nine ounces the light weight of Venice.

ABUKESO, in commerce, the same with ASLAN.

ABULFARAGIUS, GREGORY, son of Aaron a physician, born in 1226, in the city of Malatia, near the source of the Euphrates in Armenia. He followed the profession of his father; and practised with great success: but he acquired a higher reputation by the study of the Greek, Syriac, and Arabic languages, as well as by his knowledge of philosophy and divinity; and he wrote a history which does great honour to his memory. It is written in Arabic, and divided into dynasties. It consists of ten parts, being an epitome of universal history from the creation of the world to his own time. The parts of it relating to the Saracens, Tartar Moguls, and the conquests of Jenghis Khan, are esteemed the most valuable. He professed Christianity, and was bishop of Aleppo, and is supposed to have belonged to the sect of the Jacobites. His contemporaries speak of him in a strain of most extravagant panegyric. He is styled the *king of the learned*, the *pattern of his times*, the *phoenix of the age*, and the *crown of the virtuous*. Dr Pococke published his history with a Latin translation in 1663.

ABULFAZEL, an eastern writer of eminence. See SUPPLEMENT.

ABUNA, the title given to the archbishop or metropolitan of Abyssinia.

ABUNDANT NUMBER, in *Arithmetic*, is a number, the sum of whose aliquot parts is greater than the

number itself. Thus the aliquot parts of 12, being 1, 2, 3, 4, and 6, they make, when added together, 16. An abundant number is opposed to a *deficient* number, or that which is greater than all its aliquot parts taken together; as 14, whose aliquot parts are 1, 2, and 7, which makes no more than 10: and to a *perfect* number, or one to which its aliquot parts are equal, as 6, whose aliquot parts are 1, 2, and 3.

ABUNDANTIA, a heathen divinity, represented in ancient monuments under the figure of a woman with a pleasing aspect, crowned with garlands of flowers, pouring all sorts of fruits out of a horn which she holds in her right hand, and scattering grain with her left, taken promiscuously from a sheaf of corn. On a medal of Trajan she is represented with two cornucopie.

ABUSAID EBN ALJAPTU, sultan of the Moguls, succeeded his father, anno 717 of the Hegira. He was the last monarch of the race of Jenghis Khan, who held the undivided empire of the Moguls; for after his death, which happened the same year that Tamerlane was born, it became a scene of blood and desolation, and was broken into separate sovereignties.

ABUS, in *Ancient Geography*, a river of Britain, formed by the confluence of the Ure, the Derwent, Trent, &c. falling into the German sea, between Yorkshire and Lincolnshire, and forming the mouth of the Humber.

ABUSE, an irregular use of a thing, or the introducing something contrary to the true intention thereof. In grammar, to apply a word *abusively*, or in an *abusive* sense, is to misapply or pervert its meaning.—A permutation of benefices, without the consent of the bishop, is termed *abusive*, and consequently null.

ABU-TEMAN, an Arabian poet. See SUPPLEMENT.

ABUTILON, in *Botany*, the trivial name of several species of the sida. See SIDA, BOTANY Index.

ABYDOS, in *Ancient Geography*, anciently a town built by the Milesians, in Asia, on the Hellespont, where it is scarce a mile over, opposite to Sestos on the European side. Now both are called the *Dardanelles*. Abydos lay midway between Lampsacus and Ilium, famous for Xerxes's bridge, (Herodotus, Virgil;) and for the loves of Leander and Hero, (Musæus, Ovid;) celebrated also for its oysters (Ennius, Virgil). The inhabitants were a soft effeminate people, given much to detraction; hence the proverb, *Ne temere Abydum calcare*, when we would caution against danger, (Stephanus).

ABYDOS, in *Ancient Geography*, an inland town of Egypt, between Ptolemais and Diospolis Parva, towards Syene; famous for the palace of Memnon and the temple of Osiris. A colony of Milesians; (Stephanus). It was the only one in the country into which the singers and dancers were forbidden to enter.

The city, reduced to a village under the empire of Augustus, now presents to our view only a heap of ruins without inhabitants; but to the west of these ruins is still found the celebrated tomb of Osymandes. The entrance is under a portico 60 feet high, and supported by two rows of massy columns. The immovable solidity of the edifice, the huge masses which compose it, the hieroglyphics it is loaded with, stamp it a work of the ancient Egyptians. Beyond it is a temple 300 feet long and 145 wide. Upon entering the monument we meet with an immense hall, the roof of which

Abubeker
||
Abundant.

Abundant
||
Abydos.

Abydos

Abyss.

which is supported by 28 columns 60 feet high, and 19 in circumference at the base. They are 12 feet distant from each other. The enormous stones that form that ceiling, perfectly joined and incrustated, as it were, one in the other, offer to the eye nothing but one solid platform of marble 126 feet long and 26 wide. The walls are covered with hieroglyphics. One sees there a multitude of animals, birds, and human figures with pointed caps on their heads, and a piece of stuff hanging down behind, dressed in loose robes that come down only to the waist. The sculpture, however, is clumsy; the forms of the body, the attitudes and proportions of the members, ill observed. Amongst these we may distinguish some women suckling their children, and men presenting offerings to them. Here also we meet with the divinities of India. Monsieur Chevalier, formerly governor of Chandernagore, who resided 20 years in that country, carefully visited this monument on his return from Bengal. He remarked here the gods *Jag-grenate*, *Gones*, and *Veehnou* or *Wistnou*, such as they are represented in the temples of Indostan. A great gate opens at the bottom of the first hall, which leads to an apartment 46 feet long by 22 wide. Six square pillars support the roof of it; and at the angles are the doors of four other chambers, but so choked up with rubbish that they cannot now be entered. The last hall, 64 feet long by 24 wide, has stairs by which one descends into the subterraneous apartments of this grand edifice. The Arabs, in searching after treasure, have piled up heaps of earth and rubbish. In the part we are able to penetrate, sculpture and hieroglyphics are discoverable as in the upper story. The natives say that they correspond exactly with those above ground, and that the columns are as deep in the earth as their height above the surface. It would be dangerous to go far into those vaults; for the air of them is so loaded with a mephitic vapour, that a candle can scarce be kept burning in them. Six lions heads, placed on the two sides of the temple, serve as spouts to carry off the water. You mount to the top by a staircase of a very singular structure. It is built with stones incrustated in the wall, and projecting six feet out; so that being supported only at one end, they appear to be suspended in the air. The walls, the roof, and the columns of this edifice, have suffered nothing from the injuries of time; and did not the hieroglyphics, by being corroded in some places, mark its antiquity, it would appear to have been newly built. The solidity is such, that unless people make a point of destroying it, the building must last a great number of ages. Except the colossal figures, whose heads serve as an ornament to the capitals of the columns, and which are sculptured in *relievo*, the rest of the hieroglyphics which cover the inside are carved in stone. To the left of this great building we meet with another much smaller, at the bottom of which is a sort of altar. This was probably the sanctuary of the temple of Osiris.

ABYLA (Ptolemy, Mela); one of Hercules's pillars, on the African side, called by the Spaniards *Sierra de las Monas*, opposite to Calpe in Spain, the other pillar; supposed to have been formerly joined, but separated by Hercules, and thus to have given entrance to the sea now called the *Mediterranean*; the limits of the labours of Hercules (Pliny).

ABYSS, in a general sense, denotes something pro-

found, and, as it were, bottomless. The word is originally Greek, *αβυσσος*; compounded of the privative *α*, and *βυσος*, q. d. without a bottom.

ABYSS, in a more particular sense, denotes a deep mass or fund of waters. In this sense, the word is particularly used in the Septuagint, for the water which God created at the beginning with the earth, which encompassed it round, and which our translators render by *deep*. Thus it is that darkness is said to have been on the face of the abyss.

ABYSS is also used for an immense cavern in the earth, in which God is supposed to have collected all those waters on the third day; which, in our version, is rendered the *seas*, and elsewhere the *great deep*. Dr Woodward, in his Natural History of the Earth, asserts, That there is a mighty collection of waters enclosed in the bowels of the earth, constituting a huge orb in the interior or central parts of it; and over the surface of this water he supposes the terrestrial strata to be expanded. This, according to him, is what Moses calls the *great deep*, and what most authors render the *great abyss*. The water of this vast abyss, he alleges, communicates with that of the ocean, by means of certain hiatuses or chasms passing betwixt it and the bottom of the ocean; and this and the abyss he supposes to have one common centre, around which the water of both is placed; but so, that the ordinary surface of the abyss is not level with that of the ocean, nor at so great a distance from the centre as the other, it being for the most part restrained and depressed by the strata of earth lying upon it: but wherever these strata are broken, or so lax and porous that water can pervade them, there the water of the abyss ascends; fills up all the clefts and fissures into which it can get admittance; and saturates all the interstices and pores of the earth, stone, or other matter, all around the globe, quite up to the level of the ocean.

The existence of an abyss or receptacle of subterraneous waters, is controverted by Camerarius*; and defended by Dr Woodward chiefly by two arguments: the first drawn from the vast quantity of water which covered the earth, in the time of the deluge; the second, from the consideration of earthquakes, which he endeavours to show are occasioned by the violence of the waters in this abyss. A great part of the terrestrial globe has been frequently shaken at the same moment; which argues, according to him, that the waters, which were the occasion thereof, were coextended with that part of the globe. There are even instances of universal earthquakes; which (says he) show, that the whole abyss must have been agitated; for so general an effect must have been produced by as general a cause, and that cause can be nothing but the subterraneous abyss†.

To this abyss also has been attributed the origin of springs and rivers; the level maintained in the surfaces of different seas; and their not overflowing their banks. To the effluvia emitted from it, some even attribute all the diversities of weather and change in our atmosphere‡. Ray||, and other authors, ancient as well as modern, suppose a communication between the Caspian sea and the ocean by means of a subterranean abyss; and to this they attribute it that the Caspian does not overflow, notwithstanding the great number of large rivers it receives, of which Kempfer rec-

Abyss.

* Dissert. Taur. Acta. Erud. supp. tom. vi. p. 24.

† Hist. of the Earth. Journal de Savans, tom. lviii. p. 393.

‡ Memoirs of Literature, tom. viii. p. 101, &c.

§ Hollo-way, Introduct. to Woodward's Hist. of the Earth. Acta Erud.

1727, p. 313.

|| Physico-Theol. Disc. ii. c. 2. p. 76.

kons

Abyss. kons above 45 in the compass of 60 miles; though others suppose that the daily evaporation may suffice to keep the level.

The different arguments concerning this subject may be seen collected and amplified in "Cockburn's Inquiry into the Truth and Certainty of the Mosaic Deluge," p. 271, &c. If we believe any thing like elective attraction to have prevailed in the formation of the earth, it seems absurd to suppose that the heavier and denser bodies gave place to the more light and fluid; that the central part should consist of water only, and the more superficial part of a crust or shell. See DELUGE.

ABYSS is also used to denote hell; in which sense the word is synonymous with what is otherwise called

Barathrum, Erebus, and Tartarus; in the English Bible, the *bottomless pit*. The unclean spirits expelled by Christ, begged, *ne imperaret ut in abyssum irent*, according to the vulgate; *us abyssos*, according to the Greek, Luke viii. 31. Rev. ix. 1.

ABYSS is more particularly used, in antiquity, to denote the temple of Proserpine; so called on account of its riches.

ABYSS is also used in *Heraldry* to denote the centre of an escutcheon. In which sense a thing is said to be borne in abyss, *en abysme*, when placed in the middle of the shield, clear from any other bearing: He bears azure, a flower de lis, in abyss.

Abyss.

ABYSSINIA.

Abyssinia.

ABYSSINIA, ABASSIA, or UPPER ETHIOPIA, in *Geography*, an empire of Africa within the torrid zone, which is comprehended between the 7th and 16th degrees N. Lat. and the 30th and 40th degrees of E. Long. By some writers of antiquity the title of *Ethiopian*s was given to all nations whose complexion was black; hence we find the Arabians, as well as many other Asiatics, sometimes falling under this denomination; besides a number of Africans whose country lay at a distance from Ethiopia properly so called. Thus the Africans in general were divided into the western or *Hesperian Ethiopians*, and those above Egypt situated to the east; the latter being much more generally known than the former, by reason of the commerce they carried on with the Egyptians.

Different names.

From this account we may easily understand why there should be such a seeming disagreement among ancient authors concerning the situation of the empire of Ethiopia, and likewise why it should pass under such a variety of names. Sometimes, for example, it was named *India*, and the inhabitants *Indians*; an appellation likewise applied to many other distant nations. It was also denominated *Atlantia* and *Ethria*, and in the most remote periods of antiquity *Cephenia*; but more usually *Abasene*, a word somewhat resembling *Abassia* or *Abyssinia*, its modern names. On the other hand, we find Persia, Chaldæa, Assyria, &c. styled *Ethiopia* by some writers: and all the countries extending along the coasts of the Red sea were promiscuously denominated *India* and *Ethiopia*. By the Jews the empire of Ethiopia was styled *Cush* and *Ludim*.

Situation of Ethiopia Propria.

Notwithstanding this diversity of appellations, and vast diffusion of territory ascribed to the Ethiopians, there was one country to which the title was thought more properly to belong than to any of the rest; and which was therefore called *Ethiopia Propria*. This was bounded on the north by Egypt, extending all the way to the lesser cataract of the Nile, and an island named *Elephantine*; on the west it had Libya Interior; on the east the Red sea, and on the south unknown parts of Africa; though these boundaries cannot be fixed with any kind of precision.

Different nations according to the ancients.

In this country the ancients distinguished a great variety of different nations, to whom they gave names either from some personal circumstance, or from their

manner of living. The principal of these were, 1. The *Blemmyes*, seated near the borders of Egypt; and who, probably from the shortness of their necks, were said to have no heads, but eyes, mouths, &c. in their breasts. Their form must have been very extraordinary, if we believe Vopiscus, who gives an account of some of the captives of this nation brought to Rome. 2. The *Nubatae*, inhabiting the banks of the Nile near the island Elephantine already mentioned, said to have been removed thither by Oasis to repress the incursions of the Blemmyes. 3. The *Troglodytes*, by some writers said to belong to Egypt, and described as little superior to brutes. 4. The *Nubians*, of whom little more is known than their name. 5. The *Pigmies*, by some supposed to be a tribe of Troglodytes; but by others placed on the African coast of the Red sea. 6. The *Avalitæ* or *Abalite*, of whom we know nothing more than that they were situated near the Abalitic gulf. 7. The *Struthiophagi*, so called from their feeding upon ostriches, were situated to the south of the Memnonnes. 8. The *Acridophagi*; 9. *Chelonophagi*; 10. *Ichthyophagi*; 11. *Cynamolgi*; 12. *Elephantophagi*; 13. *Rhizophagi*; 14. *Spermatophagi*; 15. *Hylophagi*; and, 16. *Ophiophagi*: all of whom had their names from the food they made use of, viz. locusts, tortoises, fish, bitches milk, elephants, roots, fruits or seeds, and serpents. 17. The *Hylogones*, neighbours to the Elephantophagi, and who were so savage that they had no houses, nor any other places to sleep in but the tops of trees. 18. The *Pamphagi*, who used almost every thing indiscriminately for food. 19. The *Agrizophagi*, who lived on the flesh of wild beasts. 20. The *Anthropophagi*, or man-eaters, are now supposed to have been the Caffres, and not any inhabitants of Proper Ethiopia. 21. The *Hippophagi*, or horse-eaters, who lay to the northward of Libya Incognita. 22. The *Macrobii*, a powerful nation, remarkable for their longevity; some of them attaining the age of 120 years. 23. The *Sambri*, situated near the city of Tenupsis in Nubia upon the Nile; of whom it is reported that all the quadrupeds they had, not excepting even the elephants, were destitute of ears. 24. The *Asachæ*, a people inhabiting the mountainous parts, and continually employed in hunting elephants. Besides these, there were a number of other nations or tribes, of whom

Abyssinia.

Abyssinia. whom we scarce know any thing but the names; as the Gapachi, Ptoemphanes, Catadupi, Pechini, Catadræ, &c.

First settlement.

In a country inhabited by such a variety of nations, all in a state of extreme barbarism, it is rather to be wondered that we have any history at all, than that it is not more distinct. It has already been observed, that the Jews, from the authority of the sacred writers no doubt, bestowed the name of *Cush* upon the empire of Ethiopia; and it is generally agreed that Cush was the great progenitor of the inhabitants. In some passages of Scripture, however, it would seem that *Cush* was an appellation bestowed upon the whole peninsula of Arabia, or at least the greater part of it. In others, the word seems to denominate the country watered by the Araxes, the seat of the ancient Scythians or Cushites; and sometimes the country adjacent to Egypt on the coast of the Red sea.

Peopled originally from Arabia.

A number of authors are of opinion, that Ethiopia received its first inhabitants from the country lying to the east of the Red sea. According to them, the descendants of Cush, having settled in Arabia, gradually migrated to the south-eastern extremity of that country; whence, by an easy passage across the straits of Babelmandel, they transported themselves to the African side, and entered the country properly called *Ethiopia*: a migration which, according to Eusebius, took place during the residence of the Israelites in Egypt; but, in the opinion of Syncellus, after they had taken possession of Canaan, and were governed by judges.

Abyssinian tradition concerning it.

Mr Bruce makes mention of a tradition among the Abyssinians, which, they say, has existed among them from time immemorial, that very soon after the flood, Cush the grandson of Noah, with his family, passed through Atbara, then without inhabitants, till they came to the ridge of mountains which separates that country from the high lands of Abyssinia. Here, still terrified with the thoughts of the deluge, and apprehensive of a return of the same calamity, they chose to dwell in caves made in the sides of those mountains, rather than trust themselves in the plains of Atbara; and our author is of opinion, that the tropical rains, which they could not fail to meet with in their journey southward, and which would appear like the return of the deluge, might induce them to take up their habitations in these high places. Be this as it will, he informs us that it is an undoubted fact, "that here the Cushites, with unparalleled industry, and with instruments utterly unknown to us, formed to themselves commodious, yet wonderful habitations in the heart of mountains of granite and marble, which remain entire in great numbers to this day, and promise to do so till the consummation of all things."

Original habitations of the Cushites.

The Cushites having once established themselves among these mountains, continued to form habitations of the like kind in all the neighbouring ones; and thus following the different chains (for they never chose to descend into the low country), spread the arts and sciences, which they cultivated, quite across the African continent from the eastern to the western ocean. According to the tradition above mentioned, they built the city of Axum early in the days of Abraham. This, though now an inconsiderable village, was anciently noted for its superb structures, of which some remains are still visible. Among these are some be-

Description of the city of Axum.

longing to a magnificent temple, originally 110 feet in length, and having two wings on each side; a double porch; and an ascent of 12 steps. Behind this stand several obelisks of different sizes, with the remains of several others which have been destroyed by the Turks. There is also a great square stone with an inscription, but so much effaced that nothing can be discovered excepting some Greek and Latin letters, and the word *Basilus*. Mr Bruce mentions some "prodigious fragments of colossal statues of the dog-star" still to be seen at this place; and "*Seir* (addo he), which, in the language of the Troglodytes, and in that of the low country of Meroe, exactly corresponding to it, signifies a *dog*, instructs us in the reason why this province was called *Sirè*, and the large river which bounds it *Siris*."

Soon after building the city of Axum, the Cushites founded that of Meroe, the capital of a large island or peninsula formed by the Nile, much mentioned by ancient historians, and where, according to Herodotus, they pursued the study of astronomy in very early ages with great success. Mr Bruce gives two reasons for Meroe why they building this city in the low country, after having founded.

1. They had discovered some inconveniencies in their caves both in *Sirè* and the country below it, arising from the tropical rains in which they were now involved, and which prevented them from making the celestial observations to which they were so much addicted. 2. It is probable that they built this city farther from the mountains than they could have wished, in order to avoid the fly with which the southern parts were infested. This animal, according to Mr Bruce, who has given a figure of it, is the most troublesome to quadrupeds that can be imagined. He informs us, that it infests those places within the tropical rains where the soil is black and loamy, and no other place whatever. It is named *zimb* (by whom we are not informed), and has not been described by any other naturalist. It is of a size somewhat larger than a bee, thicker in proportion, and having broader wings, placed separate like those of a fly, and quite colourless, or without any spots. The head is large, with a sharp upper jaw; at the end of which is a strong pointed hair about a quarter of an inch long; and the lower jaw has two of these hairs: all of which together make a resistance to the finger equal to that of a strong hog's bristle. One or all of these hairs are used as weapons of offence to the cattle; but what purpose they answer to the animal itself, our author does not say. So intolerable, however, are its attacks to the cattle, that they no sooner hear its buzzing, than they forsake their food, and run about till they fall down with fright, fatigue, and hunger. Even the camel, though defended by a thick and strong skin with long hair, cannot resist the punctures of this insect; which seem to be poisonous, as they produce large putrid swellings on the body, head, and legs, which at last terminate in death. To avoid this dreadful enemy, the cattle must all be removed as quick as possible to the sandy parts of Atbara, where they stay as long as the rains last, and where this dreadful enemy never ventures to follow them. The elephant and rhinoceros, who, on account of the quantity of food they require, cannot remove to these barren places, roll themselves in the mud, which when dry, coats them over so hard, that

Description of a pestilential fly.

Abyssinia. that they are enabled to resist the punctures of the insect; though even on these some tubercles are generally to be met with, which our author attributes to this cause. Mr Bruce is of opinion, that this is the fly mentioned by Isaiah, chap. vii. 18. 19. "And it shall come to pass, that in that day the Lord shall hiss for the fly that is in the uttermost part of the rivers of Egypt; and they shall come and shall rest all of them in the desolate valleys, and in the holes of the rocks, and upon all thorns, and upon all bushes." "That is (says Mr Bruce), they shall cut off from the cattle their usual retreat to the desert, by taking possession of these places, and meeting them there, where ordinarily they never come, and which therefore are the refuge of the cattle."

Meroe, which lay in N. Lat. 16°, the exact limit of the tropical rains, was without the bounds assigned by nature to these destructive insects; and consequently a place of refuge for the cattle. Mr Bruce, on his return through the desert, saw at Gerri, in this latitude, ruins, supposed to be those of Meroe, and caves in the mountains immediately above them; for he is of opinion, that they did not abandon their caverns immediately after they began to build cities. As a proof of this, he mentions that Thebes, in Upper Egypt, was built by a colony of Ethiopians; and that near the ruins of that city, a vast number of caves are to be seen even up to the top of a mountain in the neighbourhood: all of which are inhabited at this day. By degrees, however, they began to exchange these subterraneous habitations for the cities they built above ground; and thus became farmers, artificers, &c. though originally their sole employment had been commerce.

Magnificence of the ancient Indians and Egyptians. On this subject Mr Bruce has given a very curious dissertation; though how far the application of it to the Ethiopians may be just, we cannot pretend to determine. He begins with observing, that the magnificence of the Indians and Egyptians has been celebrated from the most remote antiquity, without any account of the sources from whence all this wealth was derived: and indeed it must be owned, that in all histories of these people, there is a strange deficiency in this respect. The kings, we are to suppose, derived their splendour and magnificence from their subjects; but we are quite at a loss to know whence their subjects had it: and this seems the more strange, that in no period of their history are they ever represented in a poor or mean situation. Nor is this difficulty confined to these nations alone. Palestine, a country producing neither silver nor gold, is represented by the sacred writers as abounding in the early ages with both those metals in a much greater proportion than the most powerful European states can boast of, notwithstanding the vast supplies derived from the lately discovered continent of America. The Assyrian empire, in the time of Semiramis, was so noted for its wealth, that M. Montesquieu supposes it to have been obtained by the conquest of some more ancient and richer nation; the spoils of which enriched the Assyrians, as those of the latter afterwards did the Medes. This, however, Mr Bruce very justly observes, will not remove the difficulty, because we are equally at a loss to know whence the wealth was derived to that former nation; and it is very unusual to find an empire or kingdom of any extent enriched by conquest. The kingdom of Mace-

don, for instance, though Alexander the Great overran and plundered in a very short time the richest empire in the world, could never vic with the wealth of Tyre and Sidon. These last were commercial cities; and our author justly considers commerce as the only source from whence the wealth of a large kingdom ever was or could be derived. The riches of Semiramis, therefore, were accumulated by the East India trade centering for some time in her capital. While this was suffered to remain undisturbed, the empire flourished: but by an absurd expedition against India itself, in order to become mistress at once of all the wealth it contained, she lost that which she really possessed; and her empire was soon after entirely ruined. To the same source he attributes the riches of the ancient Egyptians; and is of opinion, that Sesostris opened up to Egypt the commerce with India by sea; though other authors speak of that monarch in very different terms. As the luxuries of India have somehow or other become the objects of desire to every nation in the world, this easily accounts for the wealth for which Egypt has in all ages been so much celebrated, as well as for that with which other countries abounded; while they served as a medium for transmitting those luxuries to other nations, and especially for the riches of those which naturally produced the Indian commodities so much sought after. This was the case particularly with Arabia, some of the productions of which were very much coveted by the western nations; and being, besides, the medium of communication between the East Indies and western nations, it is easy to see why the Arabian merchants soon became possessed of immense wealth.

Abyssinia.

Besides the territories already mentioned, the Cushites had extended themselves along the mountains which run parallel to the Red sea on the African side; which country, according to Mr Bruce, has "in all times been called *Sabo*, or *Azabo*, both which signify *South*; an epithet given from its lying to the southward of the Arabian gulf, and which in ancient times was one of the richest and most important countries in the world. "By that acquisition (says our author), they enjoyed all the perfumes and aromatics in the east; myrrh, and frankincense, and cassia; all which grow spontaneously in that stripe of ground from the bay of Bilur west of Azab to Cape Gardafui, and then southward up in the Indian ocean, to near the coast of Melinda, where there is cinnamon, but of an inferior kind." As the Cushites or Troglodytes advanced still farther south, they met not only with mountains, in which they might excavate proper habitations, but likewise with great quantities of gold and silver furnished by the mines of Sofala, which, our author says, furnished "large quantities of both metals in their pure and unmixed state, lying in globules without any alloy or any necessity of preparation or separation." In other parts of his work, he labours to prove Sofala to have been the *Ophir* mentioned in Scripture.

Thus the Ethiopians, for some time after their settlement, according to Mr Bruce, must have been a nation of the first importance in the world. The northern colonies from Meroe to Thebes built cities, learned and made improvements in architecture; cultivated commerce, agriculture, and the arts; not forgetting

The Ethiopians at first a civilized and learned people.

Abyssinia. the science of astronomy, for which they had an excellent opportunity by reason of the clearness of the sky in the Thebaid. Their brethren farther to the south, or those who inhabited Ethiopia properly so called, were confined for six months to their caves by reason of the tropical rains, whence they were naturally led to pursuits of another kind. "Letters", at least one kind of them, and arithmetical characters (we are told), were invented by this middle part of the Cushites; while trade and astronomy, the natural history of the winds and seasons, were what necessarily employed that part of the colony established at Sofala most to the southward."

* Bruce's Travels.

Account of the Ethiopian Shepherds.

While the Cushites were thus employed at home in collecting gold, gathering and preparing spices, &c. these commodities were sent abroad into other countries by another set of people, named *Shepherds*, who acted as carriers to them, and who afterwards proved so formidable to the Egyptians. These differed in their appearance from the Ethiopians, having long hair, and the features of Europeans; and were of a very dark complexion, though not at all like the blackmoors or negroes. They lived in the plain country in huts or moveable habitations, attending their cattle, and wandering up and down as various circumstances required. By acting as carriers to the Cushites, they became a great and powerful people, possessing vast numbers of cattle, as well as a very considerable extent of territory. They possessed a stripe of land along the Indian ocean; and to the northward of that another along the Red sea: but their principal habitation was the flat part of Africa between the northern tropic and the mountains of Abyssinia, which country is now called *Beja*. This reaches from Masuah along the sea-coast to Suakem; then turns westward, and continues in that direction, having the Nile on the south, the tropic of Cancer on the north, with the deserts of Selima and Libya on the west. The next district belonging to these people was Meroe, now called *Atbara*, lying between the rivers Nile and Astaboras. A third district, now called *Derkin*, is a small plain lying between the river Mareb on the east, and Atbara on the west. But the most noble and warlike of all the Shepherds were those who possessed the mountains of Habab, reaching from the neighbourhood of Masuah to Suakem: which district is still inhabited by them.

Different classes of them.

These Shepherds, according to our author, were distinguished by several different appellations, which may be supposed to denote different degrees of rank among them. Those called simply *Shepherds*, our author supposes to have been the common sort who attended the flocks. Another set were called *Hycsos* or *Agsos*, signifying "armed shepherds," who are supposed to have been the soldiers. A third were named *Agag*, supposed to be the chiefs or nobles of these armed shepherds; whence the title of *king of kings*, according to Mr Bruce, is derived; and he supposes *Agag* killed by Samuel to have been an Arabian shepherd.

The building of Carthage augmented the power of the Shepherds to a considerable degree, by reason of the vast quantity of carriage naturally belonging to a place of such extensive commerce, and which fell into the hands of the Lehabim, Lubim, or Libyan peasants. An immense multitude of camels, in the early

ages, answered the purpose of navigation: and thus we find that commerce was carried on by the Ishmaelites as early as the days of Joseph, from the southern extremity of the Arabian peninsula. These Shepherds, however, though generally the friends and allies of the Egyptians, who were also Cushites, sometimes proved very bitter enemies to them, as is related in the history of that country. The reason of this may be deduced from the great opposition betwixt their manners and customs. The Egyptians worshipped black cattle, which the Shepherds killed and used as food; the latter worshipped the heavenly bodies, while the Egyptians were the grossest idolaters, and worshipped idols of all kinds that can be imagined. Hence a mere difference in religion might occasion many bloody quarrels; though, if the above account can be depended upon as authentic, it is natural to imagine that the mutual connection of interests should have cemented their friendship, whatever difference there might happen to be in opinions of any kind.

Besides the Cushites and Shepherds, however, we must now seek for the origin of those different nations which have already been mentioned. Mr Bruce allows that there are various nations inhabiting this country, who are fairer than either the Cushites or the Shepherds, and which, though they have each a particular name, are all known by the general title of *Habesk*; which may be translated by the Latin word *convenæ*, signifying a number of distinct people meeting accidentally in one place; and which our author maintains against Scaliger, Ludolf, and a number of others, to be a very just translation, and quite consonant to the history of the country.

The most authentic ancient history of this country, according to Mr Bruce, is the chronicle of Axum; the character of which, among the modern Abyssinians, stands next to the sacred writings themselves; and consequently must be esteemed the highest Abyssinian authority we have on the subject. According to this book, there was an interval of 5500 years between the creation of the world and the birth of Christ; 1808 years before which last event the empire of Abyssinia or Ethiopia received its first inhabitants. Two hundred years after its settlement, it was so destroyed by a flood that it received the name of *Curé Midra*, or a country laid waste; "or (says our author) as it is called in Scripture, a land which the waters or floods had spoiled," (Isaiah xviii. 2.). The peopling of the country was finished about 1400 years before Christ, by the settlement of a great number of people, speaking different languages, who sat down peaceably in the high lands of Tigré, in the neighbourhood of the Shepherds, with whom they were in friendship. These people, according to tradition, came from Palestine; and our author is inclined to believe the whole of the relation to be true, as the time coincides with the expulsion of the Canaanitish nations by Joshua, which happened about 1490 B. C. ten years before which there had been, according to Pausanias, a flood in Ethiopia which occasioned prodigious devastation. Ethiopia, he thinks, would afford the most ready asylum for the fugitive Canaanites, as they must have long had a commercial intercourse with that country; and he supports the opinion likewise from what Procopius mentions of two pillars extant in his time, on the coast

Abyssinia. Reason of the enmity between the Shepherds and Egyptians.

Origin of the different Ethiopian nations.

The country laid waste by a deluge.

Abyssinia. coast of Mauritania, with the following inscription in the Phœnician language: "We are Canaanites, flying from the face of Joshua the son of Nun, the robber." The authenticity of these inscriptions, however, is much disputed, and therefore it cannot go a great way in establishing any historical point. The first and most considerable of the colonies above mentioned settled in the province of Amhara; the second in Damot, one of the southern provinces; the third in another province called *Lasta*, or *Tcheratz-Agow*, from *Tchera* their principal habitation; and a fourth in the territory of Galat.

Ethiopia
conquered
by Moses.

Our author goes on to prove, that the Ethiopians in ancient times were not only the most learned people in the world, but that they spoke the original language, and were the inventors of writing. In what manner they came to degenerate from this character, and into their present state of barbarity, cannot be known; this being a phenomenon equally unaccountable with the degeneracy of the Egyptians. According to some authors, the Ethiopians were conquered by Moses; of which transaction we have the following account. Before the time of that legislator, the Ethiopians possessed the country of Thebais in Egypt: but, not content with this, they made an irruption into Lower Egypt, and penetrated as far as Memphis; where, having defeated the Egyptians, they threatened the kingdom with total destruction. The Egyptians, by the advice of their oracles, put Moses at the head of their forces; who immediately prepared for invading the enemy's country. The Ethiopians imagined that he would march along the banks of the Nile; but Moses chose rather to pass through some of the interior countries, though greatly infested with serpents, and where consequently his march must be attended with much danger. To preserve his men, he constructed a number of chests or panniers of the Egyptian reed papyrus, which he filled with the birds named *Ibis*, celebrated for their antipathy to serpents. As soon as he approached the tract abounding with these reptiles, a sufficient number of the birds were let out, who presently cleared the way for the army by destroying the serpents. Thus the Ethiopians were surprised in their own country, where they had dreaded no invasion; their forces, being defeated in the field, were at last shut up in the capital Meroe, a city almost impregnable, by being surrounded with three rivers, the Nile, Astapus, and Astaboras. The daughter of the Ethiopian monarch, however, having an opportunity of seeing Moses from the walls, fell in love with him, and offered to deliver up the city, provided he would swear to marry her. With this requisition the Jewish legislator complied; but treated the inhabitants with great severity, plundering the city, and putting many of the inhabitants to death. After this he ravaged the whole country, dismantling all the places of strength; and having thus rendered the Ethiopians incapable of attempting any thing against other nations for a considerable time, he returned in triumph to Egypt, after an absence of ten years.

From the time of Moses to that of Solomon, there is a chasm in the Ethiopic history. After this, however, we are furnished with some kind of regular accounts. The history commences with the queen of

Sheba, who came to visit the Jewish monarch, and whom the Abyssinians suppose to have been sovereign of Ethiopia Propria; but Mr Bruce is of opinion that she was only sovereign of that territory on the eastern coast of Africa named *Saba*, which he says ought to be her title instead of *Sheba*. In favour of this opinion, he likewise urges that it was customary for the Sabeans, or inhabitants of the African district named *Saba*, to be governed by women; whereas those who inhabited the opposite side of the Arabian gulf, and who were named *Sabaean Arabs* or *Homerites*, were not only governed by kings, but would not allow their sovereigns to go abroad anywhere under pain of being stoned to death. The Abyssinians, as has been already hinted, claimed her for their sovereign; and he informs us, that having received an account from Tamerin an Ethiopian merchant, of the surprising wisdom and wealth of Solomon, she undertook the journey mentioned in Scripture, to ascertain the truth of the report. In this she was attended by a great many of her nobility, carrying along with her also magnificent presents for the monarch she intended to visit. According to the Abyssinian historians, she was a Pagan at the time this journey was undertaken; but being struck with admiration at the sight of Solomon's grandeur, and the wisdom he displayed, she became a convert to the true religion. Another part of her history, by no means inconsistent with the character of Solomon, is, that she returned in a state of pregnancy; and within a year was delivered of a son, named *David* by Solomon; but by his mother *Menilek*, *Menelech*, or *Menelchheck*; that is, *another self*. When he grew up he was sent to be educated at the court of his father Solomon; where having staid some time, he was accompanied home by many doctors of the law, and other Israelites of distinction, particularly Azariah the son of Zadoc the high-priest. By these the Jewish religion was established in Abyssinia, where it continued till the introduction of Christianity. The princess we speak of is named *Makeda*, *Balkes*, or *Bulkis*, by the Abyssinians. By our Saviour, and in the Ethiopic version of the Scripture, she is styled *The Queen of the South*, and is said to have come from the uttermost parts of the earth, or of the habitable world. Hence the compilers of the Universal History have inferred, that the princess styled *The Queen of Sheba* in Scripture was really sovereign of Ethiopia. "Ethiopia (say they) is more to the south of Judæa than the territory or kingdom of Saba in Arabia Felix; consequently has a better claim than that country for the dominions of the princess whom our Saviour calls *The Queen of the South*. Ethiopia is styled *the remotest part of the habitable world* by Herodotus and Strabo; and therefore better agrees with what our Saviour has said of the queen of Sheba, that she came from 'the uttermost parts of the earth,' than Arabia. Nor can it be deemed a sufficient reply to this argument, that Arabia Felix was the uttermost part of the earth in respect to Judæa, since it was bounded by the Red sea: for that not only Egypt, but even Ethiopia, regions beyond that sea, were known to and had a communication with the Jews, both before and in our Saviour's time, is indisputably clear. Lastly, From what has been suggested, it appears no improbable conjecture, that Judaism was not only known, at least in a part of

Abyssinia.
Of the
queen of
Sheba.

Ethiopia,

Abyssinia.

Ethiopia, but nearly related to the established religion there, at the beginning of the apostolic age, if not much earlier. After all, these two opinions, so contrary in appearance, may be made consistent without great difficulty; since it is agreed, that Arabia and Ethiopia have anciently borne the same name, been included during certain intervals in one empire, and governed by one prince. Part of the Arabs and Ethiopians had the same origin, and very considerable numbers of the Abaseni transported themselves from Arabia Felix into Ethiopia; a circumstance which sufficiently proves the intercourse that formerly subsisted between the Cushites or Ethiopians of Asia and Africa.

The Abyssinian historians farther inform us, that the young prince Menilek was anointed and crowned king in the temple of Jerusalem, before he returned to his own country; that Azariah was constituted high-priest; that he brought with him a Hebrew transcript of the law; and though this book is now lost, having been burnt along with the church of Axum, the office is still continued in the line of Azariah, whose successors are styled *Nebrits, high priests, or keepers of the church* in that city; both church and state being modelled exactly after that of Jerusalem. Makeda continued to enjoy the sovereignty for 40 years; and the last act of her reign was to settle the succession to the throne. By this act the crown was declared hereditary in the family of Solomon for ever; it was also determined, that after her no woman should be entitled to wear the crown or act as sovereign of the country; but that the sovereignty should descend to the most distant heirs male, rather than to the females, however near; which two articles were to be considered as fundamental laws of the empire, not to be abolished. Lastly, That the male heirs of the royal family should always be sent prisoners to a high mountain, where they were to be confined till they should be called to the throne, or as long as they lived. This custom, according to Mr Bruce, was peculiar to Abyssinia; the neighbouring Shepherds being accustomed to have women for their sovereigns, which prevailed in the last century, and perhaps does so at present.

Makeda having established these laws in such a manner as not to be revocable, died in the year 986 B. C. The transactions of her son Menilek after his accession are not pointed out, farther than that he removed his capital to Tigré. His reign can by no means be accounted prosperous; since in his time the empire was invaded by Shishak or Sesak the king of Egypt, who plundered the temple of Jerusalem under Rehoboam. The like fate attended a rich temple which had been built at Saba the capital of the Ethiopian empire, and which might very probably occasion the removal of the imperial seat to Tigré, as already mentioned. It is indeed pretty plain from Scripture, that Ethiopia, or great part of it, was subject to this monarch; as the Ethiopians or Cushites, mentioned in his army which invaded Judea, are joined with the Lubim or Libyans, and must therefore be accounted inhabitants of Ethiopia Proper. This is indeed no small confirmation of the opinion of Sir Isaac Newton, who agrees with Josephus in supposing Shishak to have been the celebrated Sesostrius of profane historians. Thus far we are certain, that in the passage of Scripture just

now alluded to, the sacred historian indirectly ascribes the sovereignty of Ethiopia to Shishak; and we do not find it anywhere hinted that another Egyptian monarch was possessed of this sovereignty. Herodotus also plainly tells us, that Sesostrius was master of Ethiopia, and that no other Egyptian but himself ever possessed that empire.

During the reign of Shishak, we know no particulars concerning the Ethiopians; but after his death, Sir Isaac Newton is of opinion, that they defended Egypt against the Libyans, who had taken an opportunity of invading the country during the civil war which took place on the death of that great conqueror. In about ten years afterwards, however, according to the same author, they became aggressors; drowned the successor of Shishak in the Nile, and seized on the whole kingdom; at which time Libya also fell into their hands. In the time of Asa king of Judah, we find the combined host of the Ethiopians and Lubim or Libyans, making an attack on the territories of that prince, to the number of more than a million. This may be reckoned a considerable confirmation of the piece of history just mentioned; as it is not easy to conceive how the two should combine in such a manner, unless Zerah was master of both. The total overthrow which the allied army received from Asa, gave the inhabitants of Lower Egypt an opportunity of revolting; who being sustained by an army of 20,000 auxiliaries from Phœnicia and Palestine, obliged Memnon, supposed to be the same with Amenophis, to retire to Memphis. Soon after this he was forced to leave Egypt altogether, and to retire into Ethiopia; but in about 13 years he returned with his son Ramesses at the head of a powerful army, and obliged the Canaanitish forces to retire out of Lower Egypt; a transaction denominated by the Egyptian writers the *second expulsion of the Shepherds*.

Sir Isaac Newton is of opinion, that the Egyptian princes Menes, Memnon, and Amenophis, were the same person; and that by him Memphis was either originally built or first fortified, in order to prevent the Egyptians from entering Ethiopia. He is also supposed to have been the son of Zerah, and to have died at a very advanced age about 90 years after the decease of Solomon. Thus, according to Sir Isaac Newton's chronology, the most remarkable transactions of antiquity will be brought lower by ages than by the usually received computations. According to this, the Argonautic expedition happened in the time of Amenophis; though some Greek writers inform us, that the same prince assisted Priam king of Troy with a body of forces. He was succeeded by Ramesses, already mentioned, who built the northern portico of the temple of Vulcan at Memphis. The next was Moeris; who adorned Memphis, and made it the capital of his empire, about two generations after the Trojan war. Cheops, Caphrenus, and Mycerinus, succeeded in order to Moeris; the last being succeeded by his sister Nitocris. In the reign of Asychis her successor, both Ethiopia and Assyria revolted from Egypt; which, being now divided into several small kingdoms, was quickly subdued by Sabacon or So, the emperor of Ethiopia. This monarch, soon after his accession to the throne of Egypt, allied himself with Hoshea king of Israel; by which means the latter was induced to revolt

Ethiopia
conquered
by Shishak.

Of Menes
and his suc-
cessors.

Defeat of
Zerah by
Asa king of
Judah.

Abyssinia.

Revolu-
tions after
the time of
Shishak.

byssinia. revolt from the Assyrians; and in consequence of this, an end was put to the kingdom of Israel by Shalmaneser king of Assyria, in the 24th year of the era of Nabonassar, and 720th before the commencement of the Christian era. According to Herodotus, this monarch voluntarily resigned the crown of Egypt after he had enjoyed it 50 years; but Africanus relates, that after a reign of eight years, he died in Egypt, in the ninth year of Hezekiah king of Judah. His successor Sethon, supposed to be the Sevechus of Manetho, advanced to Pelusium with a powerful army against Sennacherib king of Assyria; when the bowstrings of the Assyrians were gnawed in pieces by a great number of rats and mice, and thus they were easily defeated with great slaughter by the Egyptians. Hence Herodotus informs us, that the statue of Sethon which he saw in Egypt had a mouse in its hand. Sir Isaac Newton, however, explains the whole in an allegorical manner. As the mouse among the Egyptians was a symbol of destruction, he conjectures, that the Assyrians were on this occasion overthrown with great slaughter; and that Sethon, in conjunction with Terhakah, either king of the Arabian Cushites, or a relation of Sethon, and his viceroy in Ethiopia Proper, surprised and defeated Sennacherib betwixt Libnah and Pelusium, making as great slaughter among his troops as if their shieldstraps and bowstrings had been destroyed by mice.

In the 78th year of the era of Nabonassar, the empire of Ethiopia was subdued by Esarhaddon king of Assyria; who held it three years, committing enormous cruelties both in that country and in Egypt. After his death the Ethiopians shook off the yoke, and maintained their independency till the time of Cyrus the Great, the first king of Persia; who, according to the Greek historian Xenophon, seems to have also been sovereign of Ethiopia. After his death they revolted, and his son Cambyses unsuccessfully attempted to reduce them. Herodotus informs us, that before he undertook this expedition, he sent some of the Ichthyophagi ambassadors to the king of the Macrobii or long-lived Ethiopians, under pretence of soliciting his friendship, but in reality to observe the strength of the country. Of this the Ethiopian prince was aware, and told the ambassadors that he knew their design, reproached Cambyses with his injustice and ambition, and gave them his bow; telling them at the same time, that the Persians might think of invading Ethiopia when they could easily bend it; and in the mean time, that their master ought to thank the gods who had never inspired the Ethiopians with a desire of extending their territories by conquest. Cambyses had sent by the ambassadors a rich purple robe, gold bracelets, a box of precious ointment, a vessel full of palm wine, and other things, which he imagined would be acceptable to the Ethiopian monarch. But all these, excepting the wine, were despised. This, he owned, was superior to any liquor produced in Ethiopia; and he did not scruple to intimate, that the Persians, short-lived as they were, owed most of their days to the use of this excellent liquor. Being informed by the ambassadors that a considerable part of the food made use of by the Persians was bread, he said that it was no wonder to find people who lived on *dung* unable to attain the longevity of the Macrobian Ethiopians. In short, the

whole of his answer was so contemptuous and disgusting, that Cambyses was filled with the greatest indignation; in consequence of which, he instantly began his march without taking time to make the necessary preparations, or even to procure provisions of any kind for his army. Thus a famine ensued among them; which at last became so grievous, that the soldiers were obliged to eat one another: and Cambyses himself, finding his life in great danger, was obliged to give orders for marching back again; which was not accomplished without the loss of a great number of men. Another army which he sent on an expedition against Ammonia, in order to destroy the celebrated oracle of Jupiter Ammon, perished entirely in the deserts, being overwhelmed with the vast clouds of sand frequently raised there by the wind.

At this time, it is doubtful whether Cambyses would have accomplished his purpose even if he had found it practicable to march into the heart of Ethiopia. This empire had but a short time before received a very considerable accession of strength by the desertion of 240,000 Egyptians who had been posted by Psammetichus in different places on the frontiers. These not having been relieved for three years, had gone over at once to the emperor of Ethiopia, who placed them in a country disaffected to him; ordering them to expel the inhabitants, and take possession of their lands. Notwithstanding this, however, Sir Isaac Newton hints, that Cambyses conquered Ethiopia, about the 223d or 224th year of the era of Nabonassar; but his opinion in this respect does not appear to be well founded. We are told, indeed, that the Persian monarch, notwithstanding the misfortunes he met with in the expedition above mentioned, did really make himself master of some of the Ethiopic provinces which bordered on Egypt; and that these, together with the Troglodytes, sent him an annual present of two choenixes of unrefined gold, 200 bundles of ebony, five Ethiopian boys, and 20 elephants teeth of the largest size: but it appears improbable to the last degree, that even though Cambyses had employed the whole of his reign in the attempt, he could have conquered the vast regions of Ethiopia Proper, Sennaar, and Abassia, which were all included in the Ethiopia of the ancients.

When Xerxes invaded Greece, we find his army, according to Herodotus, was partly composed of Ethiopians, of whom Herodotus mentions two distinct races of people. One of these inhabited the Asiatic coast, and differed from the Indians only in their hair and language. Their arms were the same with those of India; they wore helmets made of the skins of horses, the ears and manes of which served them for tufts and plumes of feathers; their shields being made of the skins of cranes. The hair of the Asiatic Ethiopians was long, but that of the western tribes was frizzled. The latter were also differently armed, having darts lighted at one end and covered with leather. We are not informed particularly from what nations these troops were brought, nor whether they were natural subjects of the king of Persia, or only auxiliaries: of consequence we can conclude nothing certain concerning the dominion of the Persian monarchs at this time over Ethiopia, further than that they might possess some of the provinces next to Egypt; while the main body

Abyssinia.

Ethiopia at this time a powerful empire.

Ethiopia supposed by Sir Isaac Newton to have been conquered by Cambyses.

Ethiopians employed by Xerxes.

Abyssinia. body of the empire being in a state of independence, and unconnected with other parts of the world, is not taken notice of by the historians of those times.

**Ethiopia
conquered
by Ptolemy
Euergetes.**

Though Alexander the Great had a desire to know the sources of the Nile, he did not suffer himself to be diverted by this curiosity from pursuing his grand expedition into Persia. Ptolemy Euergetes, however, appears to have carried this curiosity to such an extremity as to invade Ethiopia for no other purpose. It is surprising that the particulars of this expedition are not recorded by any historian, as it appears by an inscription that he penetrated to the farthest parts of the empire, and conquered the most powerful nations in it. Of this we have the following account, which is looked upon by the best historians to be authentic. It was copied on the spot (being the western entrance to Adule, one of the cities of Ethiopia) by Cosmas Egyptius, or, as some call him, Cosmas Indicopleustes, in the time of the emperor Justin I. by order of Elesbaan king of the Axumites, and of which the following account is given by the person who copied it. "Here (says he), facing the road to Axuma, stood a chair of white marble, consisting of a square base, a small thin column at each angle of this base, with a larger wreathed one in the middle, a seat or throne upon these, a back and two sides. Behind this chair there was a large stone three cubits high, which had sustained considerable injury from time. This stone and chair contained an inscription to the following purpose: 'Ptolemy Euergetes penetrated to the farthest parts of Ethiopia. He subdued Gaza, Agame, Signe, Ava, Tiamo or Tziamo, Gambela, Zingabene, Angabe, Tiama, Athagaos, Calaa, Semene, Lasine, Zaa, Gabala, Atalino, Bega, the Tangaitæ, Anine, Metine, Sesea, Rauso, Solate, the territory of Rauso, and several other kingdoms. Among the nations he reduced, were some inhabiting mountains always covered with a deep snow; and others seated upon the ridges of hills, from whence issued boiling steams, and craggy precipices, which therefore seemed inaccessible. Having finally, after all these conquests, assembled his whole army at Adule, he sacrificed to Mars, Neptune, and Jupiter; for his great success, he dedicated this chair or throne to Mars.'

**Conquest
of Ethiopia
by the Ro-
mans.**

From the time of this conqueror to that of the emperor Augustus, we meet with nothing of any consequence relating to Ethiopia Proper. The Roman forces having about this time been drawn out of Egypt, in order to invade Arabia, Candace queen of Ethiopia, or perhaps rather of the island or peninsula of Meroe, took the opportunity of their absence to make an irruption, with a numerous army, into the province of Thebais. At there was at that time no force to oppose her, she met for some time with great success; but hearing at last that Petronius, governor of Egypt, was in full march to attack her, she retired into her own dominions. Petronius pursued her as far as Pselcha, where with 10,000 men he gained an easy victory over 30,000 undisciplined Ethiopian savages, armed only with poles, hatchets, and other clumsy or insignificant weapons of a similar nature. This victory was soon followed by the reduction of several fortresses; however, as the Roman soldiers were excessively incommoded by the heat of the climate, Petronius, notwithstanding his success, was obliged at

last to retire. Soon after, Candace sent ambassadors **Abyssinia.** to Augustus himself with such magnificent presents, that the emperor is said to have been thereby induced to grant her a peace on her own terms. From this time the Romans accounted themselves masters of Ethiopia. Augustus was complimented on the great glory he had acquired; and that he had, by reducing a country till that time unknown even to the Romans, finished the conquest of Africa. No material alteration, however, took place in the affairs of Meroe, in consequence of this conquest, whether real or pretended. Pliny informs us that it had been governed by queens, who bore the title of Candace, for several generations before that time; and so it continued to be afterwards, as we learn from Scripture, where we are informed that, in the reign of Tiberius, the sovereign of Ethiopia was still named Candace. Some indeed are of opinion that the Candace mentioned in the Acts of the Apostles was the same with her who had been conquered by Augustus; but this seems by no means probable, as the interval of time is by far too long to be allowed for the reign of a single princess.

From an anecdote of the debauched emperor Helio- **Account of
the Blem-
myes.** gabalus who was accustomed to confine his favourites, by way of diversion, with old Ethiopian women, we may learn that some intercourse took place between the two empires, and probably that the Ethiopians owned some kind of subjection to the Romans. The Blemmyes, a gang of monstrous banditti, who inhabited the frontiers of Thebais, were vanquished by the emperor Probus: but, towards the close of the third century, we find them again become so powerful, that in conjunction with another nation called *Nobatae*, who inhabited the banks of the Nile near Upper Egypt, they committed such depredations in the Roman territories, that Dioclesian was obliged to assign lands to the latter, and to pay both of them a considerable sum annually, to desist from their former practices. These expedients did not answer the purpose; the savages continued their depredations till the time of the emperor Justinian, who treated them with more severity, and obliged them to remain at peace. We are told by Procopius, that before the time of Dioclesian, the Roman territories extended so far into Ethiopia, that their boundaries were not 23 days journey from the capital, so that probably the whole empire had been in a state of dependence on them.

From the time of this emperor to that of their conversion to Christianity, we find nothing remarkable in the history of the Ethiopians. Three hundred and twenty seven years are counted from the time of our Saviour to that of Abreha and Atzbeha, or from Abra and Asba, who enjoyed the kingdom when the gospel was preached in Ethiopia by Frumentius. This man was a kinsman and companion of a philosopher named Meropius, a native of Tyre; who having travelled all over India, died on an island of the Red sea. **Ethiopian
converted
to Christi-
anity by
Frumen-
tius.** After his death Frumentius, with another named Aedesius, who had also been his companion, were brought before the king of Ethiopia, to whom that island was subject. He took them into his service; making the one his treasurer and the other his butler. On the death of this prince, the queen conceived such a favour for them, that she refused to allow them to depart out of the kingdom; but committed the management of her

Abyssinia. her affairs entirely to Frumentius, who made use of his influence to diffuse the Christian religion throughout the country, and at last was appointed bishop of Axuma. It is said, however, that the court and principal people, if not the nation in general, relapsed into idolatry, which continued to prevail till the year 521, when they were again converted by their king Adad or Aidog.

The two princes Abra and Asba, who reigned jointly in Ethiopia in the time of Frumentius, lived in such harmony together, that their friendship became almost proverbial. After being converted to Christianity, they adhered strictly to the orthodox doctrine, refusing to admit an Arian bishop into their country. In the time of the emperor Constantius, however, this heresy was introduced, and greatly favoured by that monarch; and an attempt was made to depose Frumentius on account of his refusal to embrace it.

The two kings refuse to admit Arianism.

Account of the war of the elephant.

The reign of these princes is remarkable for an expedition into Arabia Felix, called by the Mohammedan writers the war of the elephant, and which was undertaken on the following occasion: The temple of Mecca, situated nearly in the middle of the Arabian peninsula, had been held in the greatest veneration for near 1400 years; probably from the notion entertained by the people in the neighbourhood, that Adam pitched his tent on that spot. Here also was a black stone supposed to possess extraordinary sanctity, as being that on which Jacob laid his head when he had the vision of angels. The most probable account of the real origin of this temple, according to Mr Bruce, is, that it was built by Sesostris, and that he himself was worshipped there under the name of Osiris.

On account of the veneration in which this tower and idol were held by the Arabians, Mr Bruce supposes that the thought was first suggested of making it the emporium of the trade between India and Africa; but Abra, in order to divert it into another channel, built a very large temple near the Indian ocean in the country of the Homerites; and, to encourage the resort of people to this new temple, he bestowed upon it all the privileges of the former which stood in the city of Mecca. The tribe of Arabians named *Koreish*, in whose country Mecca stood, being exceedingly alarmed at the thoughts of having their temple deserted, entered the new one in the night, burned all that could be consumed, and besmeared the remains with human excrements. Abra, provoked at this sacrilege, assembled a considerable army, with which he invested Mecca, himself appearing on a white elephant, from whence the war took its name already mentioned.

Miraculous destruction of the Ethiopian army.

The termination of the war, according to the Arabian historians, was miraculous. A vast number of birds named *Ababil* came from the sea, having faces like lions; each carrying in its claws a small stone about the size of a pea, which they let fall upon the Ethiopian army in such numbers, that every one of them was destroyed. At this time it is said that the smallpox first made its appearance; and the more probable account of the destruction of the Ethiopian army is, that they perished by this distemper.

First appearance of the smallpox.

The war of the elephant is supposed to have terminated in the manner above mentioned about the year 360; from which time to that of Elesbaan, named also *Caleb*, and probably the same with the Adad or A-

dag already mentioned, we meet with nothing remarkable in the Ethiopic history. He engaged in a war with the Homerites or Sabæans in Arabia Felix, whom he overthrew in battle, and put an end to their kingdom; after which he embraced the Christian religion in token of gratitude for the success he had met with. In the time of this prince a violent persecution of the Christians took place in Arabia. The Jewish religion had now spread itself far into that peninsula; and in many places the professors of it were become absolute masters of the country, inasmuch that several Jewish principalities had been erected, the sovereigns of which commenced a severe persecution against the Christians. Among the rest, one Phineas distinguished himself by his cruelty, having prepared a great number of furnaces or pits filled with fire, into which he threw those who refused to renounce Christianity. The Christians applied for relief to the emperor Justin; but he being at that time engaged in a war with the Persians, could not interfere; however, in the year 522, he sent an embassy to Elesbaan, who was now also a member of the Greek church, intreating him to exert himself for the relief of the Christians of Arabia. On this the emperor commanded his general Abreha, governor of the Arabian province Yemen, to march to the assistance of Aretas, son to a prince of the same name whom Phineas had burnt; while he himself prepared to follow with a more considerable force. But before the arrival of the Ethiopian monarch, young Aretas had marched against Phineas, and entirely defeated him. In a short time afterwards the emperor himself arrived, and gave Phineas a second defeat; but notwithstanding these misfortunes, it does not appear that either the principality of Phineas or any of the other Jewish ones, was at this time overturned, though it seems to be certain, that at the time we speak of, the Ethiopians possessed part of the Arabian peninsula. According to the Arabian historians, the war of the elephant, with the miraculous destruction of the Ethiopian army, already mentioned, took place in the reign of Elesbaan.

Abyssinia. Reconversion to Christianity under Elesbaan. Christians persecuted in Arabia.

Cruelty of Phineas a Jewish prince.

He is defeated.

Some historians mention, that the Ethiopian monarchs embraced the doctrines of Mahomet soon after the impostor made his appearance; but this seems not to be well-founded; though it is certain that the *Najashi* or Ethiopian governor of Yemen embraced Mahometanism, and that he was related to the royal family. On this occasion, however, the Ethiopians lost all the footing they once had in Arabia; the governors being expelled by Mahomet and his successors. They fled to the African side of the Red sea with numbers of their subjects, where they erected several small kingdoms, as Adel, Wypo, Hadea, Mara, and others, which still continue.

Ethiopians driven out of Arabia.

During the conquests of the caliphs, the Jews were for some time everywhere driven out of their dominions, or oppressed to such a degree that they voluntarily left them. Ethiopia offered them an asylum: and in this country they became so powerful, that a revolution in favour of Judaism seemed ready to take place. One family had always preserved an independent sovereignty on a mountain called Samen, the royal residence being on the top of a high rock; and several other high and rugged mountains were used by that people as natural fortresses. Becoming by de-

Number of Jews increased.

Abyssinia. grees more and more powerful, Judith the daughter of one of their kings formed a design of overturning the Ethiopian government, and setting aside the family of Solomon, who had hitherto continued to enjoy the sovereignty. This design was facilitated by several circumstances. The empire had been weakened by an unsuccessful war, famine, and plague; the throne was possessed by an infant; and the absurd custom of confining the whole royal family on a rock named *Damo*, gave her an opportunity of cutting them all off at once by surprising that place. Fortunately, however, the king himself escaped the general catastrophe, and was conveyed by some of the nobility of Amhara to the province of Xoa or Shoa; by which means the line of Solomon was preserved, and afterwards restored, though not till after a very considerable interval.

Judith
usurps the
throne.

Judith having by this massacre established her own power, assumed the imperial dignity, though in direct opposition to an established and fundamental law of the empire already mentioned, that no woman should enjoy the sovereign authority. The people, however, seem to have submitted quietly to her government, as she sat on the throne for 40 years, and afterwards transmitted the sovereignty to her posterity; five of whom reigned successively in this country. We are not furnished with any particulars concerning their reigns; farther than that, during them, the people were greatly oppressed. By some means, of which historians have not given any account, another revolution took place; and a new set of usurpers, related to the family of Judith, but not their direct lineal descendants, succeeded to the throne. These were Christians, and governed with much greater lenity than the Jewish sovereigns had done; but still, being usurpers, none of their transactions are recorded in the Abyssinian annals, excepting those of Lalibala, who was accounted a saint. He lived in the end of the 12th or beginning of the 13th century, and proved a great prince. At that time the Christians in Egypt were grievously persecuted by the Saracens, who had a particular abhorrence at masons, builders, and stone cutters; looking upon them as the chief promoters of idolatry by the ornaments they put upon their works. These were joyfully received by Lalibala; who, by affording them an asylum in his dominions, soon collected a great number. They were employed by him in hewing churches out of the solid rock, after the example of the ancient Troglodytic habitations; and many works of this kind remain in the country to this day. He undertook, however, a still more difficult and arduous task; no less than that of lessening the stream of the Nile, and thus starving the whole kingdom of Egypt, now in the hands of his enemies, and who persecuted those of his religion. From the account given by Mr Bruce of this project, it appears that there really is a possibility in nature of accomplishing it; not indeed by turning the course of the Nile itself, but by diverting that of many of its branches, which are the means of conveying into it the water supplied by the tropical rains, and by which it overflows its banks annually. We are likewise assured by the same author, that Lalibala succeeded in his enterprise so far as to divert the course of two large rivers from the Nile, and that they have ever since flowed into the Indian ocean. He next proceeded to carry a level towards a lake named *Zacvia*,

A new re-
volution.

Christians
persecuted
in Egypt
fly to E-
thiopia.

Lalibala
undertakes
to diminish
the stream
of the Nile.

into which many rivers, whose streams contribute to increase that of the Nile, empty themselves; and had this been accomplished, there is no doubt that the loss of so much water would have been very sensibly felt by the Egyptians. According to most historians, this enterprising monarch was prevented by death from putting his design in execution; though Mr Bruce informs us of a written account at Shoa, in which it was asserted, that he was dissuaded from it by certain monks, who told him, that by sending down such a quantity of water to the eastern and dry parts of Africa, these countries would soon become so fertile and populous that they would rival the empire of Ethiopia, or at least withdraw their allegiance from it entirely. The remains of these works were seen by the Portuguese ambassador in 1522.

All this time the princes of the line of Solomon had been obliged to content themselves with the sovereignty of the province of Xoa or Shoa, without making any attempt to regain their former dignity; but they were unexpectedly restored without bloodshed or disturbance by Naacueto Laeb the grandson of Lalibala. This prince, who was of a gentle and pacific disposition, was persuaded by a monk named *Tecla Haimanout*, much celebrated for his sanctity, to resign the crown, to which, though he received it from his father, he could not pretend any absolute right. In consequence of the mediation of this monk, therefore, it was agreed that Naacueto should give up the empire to Icon Amlac the lineal descendant of Solomon, who then possessed the sovereignty of Shoa. In consequence of this a portion of lands should be irrevocably and irredeemably assigned to him and his heirs; and he should likewise be allowed some marks of sovereignty as a testimony of his former grandeur. In this treaty, however, the good monk did not forget his own interest. He had founded a famous monastery in Shoa, and was primate of the whole empire under the title of *Abuna*. He now insisted that one third of the kingdom should be absolutely ceded to himself for the maintenance of his own dignity, and the support of the clergy, convents, &c. throughout the country; he also insisted that no native Abyssinian should ever enjoy the same dignity with himself, even though he should have been chosen and ordained at Cairo, as was the custom with the Abyssinian prelates.

These extraordinary terms were complied with, and Icon Amlac raised to the throne of Ethiopia. He did not, however, remove the seat of government from the province of Shoa; but continued at Tegulat the capital of that province during the whole of his lifetime, which continued 15 years after his accession to the throne. We are ignorant of the transactions of his reign, as well as that of several of his successors; five of whom ascended the throne in as many years. From this quick succession Mr Bruce is of opinion, that a civil war had taken place among the candidates for the throne: but the Abyssinian annals make no mention of this; neither have we any particular account of the transactions of the empire till the time of Amda Sion, who began to reign in 1312. He was the son of We-Reign of dem Araad, the youngest brother of Icon Amlac, Amda Sion and succeeded to the throne on the death of his father. He professed the Christian religion; but his practice seems

Abyssinia.

Restoration
of the line
of Solomon.

Uncertain-
ty of the
Abyssinian
history.

Reign of
Amda Sion

Abyssinia. seems to have been very opposite to its precepts. He began his reign with living publicly with a concubine of his father's; and quickly after committed incest with his two sisters. On this he was first exhorted to repentance, and then excommunicated, by Honorius, a monk greatly celebrated for his sanctity, and who has since been canonized. The prince, enraged at this indignity, caused the saint to be severely whipped through every street of his capital. That night the town was by some unknown means set on fire and reduced to ashes: the clergy persuaded the people, that the blood of Honorius had turned to fire as it dropped on the ground, and thus occasioned the catastrophe; but the king suspecting that the monks themselves had been the incendiaries, banished or imprisoned them all, so that their hopes of exciting an insurrection were disappointed; and being dispersed into those provinces where the inhabitants were mostly Jews or Pagans, they were now obliged to apply to what was certainly more incumbent upon them, viz. the diffusion of the knowledge of the gospel.

The monks banished.

His expedition against the Mahometans.

While the king was busied with the monks, one of the factors, who had been entrusted with some of his commercial interests, was assassinated by the Moors in the province of Ifat; on which, without making the least complaint or expostulation, he assembled his troops, and with seven horsemen (A) fell upon the nearest Mahometan settlements, massacring all he met without exception. Putting himself then at the head of his army, he proceeded in the most rapid career of desolation, laying waste the whole country with fire and sword, and carrying off an immense booty.

They attack his camp in the night without success.

For some time the Moors were so surprised, that they did not think of making opposition; but at last they took up arms, and attempted to surprise the Abyssinian monarch in his camp, hearing that he had sent out most of his army in detachments. With this view they approached the camp in the night time, expecting to have found the king and his few soldiers immersed in sleep. Unexpectedly, however, he had been joined by a considerable part of his army, whom he drew up in battle array to receive his enemies. An engagement ensued, in which the king behaved with great valour, killed the Moorish general with his own hand, and gained a complete victory. He then commanded such of his soldiers as could not find houses ready built, to build huts for themselves, and a large tract of land to be plowed and sown, as if he meant to stay in the country of the enemy during the rainy season. The Mahometans now perceiving that they were in danger of being totally exterminated, willingly submitted to the terms he pleased to impose upon them; while the monarch conciliated the affections of his people by dividing among them the vast plunder he had acquired in this expedition.

They submit, but quickly revolt again.

The Moors no sooner found themselves freed from any apprehensions of immediate danger, than they prepared for a new revolt. The king having intelligence

of their designs, secretly prepared to subdue them before they could have time to bring their matters to a sufficient bearing. The Moors, however, being better prepared than he expected, began hostilities by surprising and plundering some villages belonging to the Christians, and destroying their churches. A most formidable combination had taken place; and as the consequence of allowing the confederate rebels to join their forces might have been very dangerous, the king used his utmost endeavours to prevent it. This design was in some measure facilitated by the superstition of Amano king of Hadea, one of the principal rebels. This man, by the advice of a conjurer in whom he put great confidence, instead of marching his troops to the assistance of his allies, remained at home with them, where he was defeated and taken prisoner by a detachment of the king's army. The governor of Amhara was next despatched against Saber-eddin the revolted governor of Fatigar, with orders to lay waste the country, and use every method to force him to a battle, if he should be disinclined to venture it himself.

King of Hadea defeated and taken prisoner.

These orders were punctually executed; Saber-eddin was compelled to stand an engagement, in which he was defeated; the victors plundered his house, and took his wife and children prisoners. But in the mean time intelligence was received of a new revolt among the Falasha, who had assembled a great army, and threatened to become very formidable; their chief keeping a close correspondence with Saber-eddin, as well as with the king of Adel. These, however, shared the same fate with the rest, being entirely defeated by Tzaga Christos another Abyssinian general, who soon after joined the king with his whole army. This proved fatal to the rebel cause: Saber-eddin, no longer able to support himself against the royal forces, was obliged to surrender at discretion, and all the rest were quickly reduced; so that the king was at leisure to march against the kings of Adel and Mara, who having now united their forces, resolved to give him battle. At this the Abyssinian monarch was so exasperated, that he determined to take the most ample vengeance on his enemies. In the presence of his whole army, therefore, and a monk of uncommon sanctity dressed in the same habit in which he usually performed divine service, the king made a long speech against the Mahometans. He recounted the many violences which they had committed; and of which the kings of Adel and Mara had been principal promoters. He enumerated many examples of murder, sacrilege, &c. of which they had been guilty; setting forth also that they had carried off great numbers of Christians into slavery, and that the view of making slaves was now a great motive with them for making war. He disclaimed every idea of commencing hostilities from any avaricious motive; as a proof of which, he denied that he would accept of any part of the plunder for his own use; concluding with a declaration, that he was now about to swear on the holy eucharist, that, "though

Another rebel chief defeated.

The Falasha defeated.

The king marches against Adel, Mara, &c.

His speech and oath in presence of his army.

H 2

but

(A) On this Mr Bruce remarks, that "it has been imagined the number should be increased to 70; but there would be little difference in the rashness of the action." The word in the Abyssinian annals which he translates is *seven*; but if we increase the number at all, it ought more probably to be *seven hundred* than *seventy*.

Abyssinia. but 20 of his army should join him, he would not turn his back upon Adel or Mara, till he had either forced them to tribute and submission, or entirely extirpated them and annihilated their religion." After this speech, he took the oath in the presence of the whole army; who not only applauded him with loud shouts, but protested that they looked upon themselves to be all bound by the oath he had taken. As he had mentioned in his speech that the plunder had been purchased by the lives of their Christian brethren, they determined to show their abhorrence at keeping any of it on these terms. Taking lighted torches in their hands, therefore, they set fire to the whole plunder that had been amassed since the beginning of the war; and having thus reduced themselves to a state of poverty, they prepared to show their Christianity by thirsting, not after the wealth, but the blood of their enemies.

Enthusiasm
of his
troops.

Notwithstanding the enthusiasm of the whole army on this occasion, the expedition was attended with great difficulties. These arose principally from superstition; and as, on the one hand, the Abyssinians were by this principle laid under considerable disadvantages, their adversaries on the other enjoyed equal advantages from no better cause. The Abyssinians, according to Mr Bruce, are very credulous with respect to genii or spirits which go about doing mischief in the dark. Hence they are afraid of travelling, but especially of fighting, in the night-time; because they imagine that the world is then entirely given up to these beings, who are put out of humour by the motions of men, or of any other terrestrial creature. In the night-time therefore an Abyssinian dares not even throw a little water out of a bason, lest it should fall upon some spirit and provoke it to vengeance. The Moors, on the other hand, though equally fearful, secure themselves against these invisible enemies by means no less ridiculous than the fears themselves. A verse of the Koran, sewed up in leather, and worn round their neck or arm, is sufficient to defy the power of the most mischievous spirit. Under such powerful protection, therefore, they laugh at the terrors of the Abyssinians, and are on all occasions ready to attack them in the night-time, and even prefer that season rather than any other for coming to an engagement. Sensible of this advantage, and encouraged by the little loss which attended even a defeat in these nocturnal encounters, they determined on the present occasion to avoid any pitched battles, and to content themselves with harassing the king's army with continual skirmishes of this kind. Thus, though the Abyssinian monarch had always the advantage, his troops soon began to complain; and, on the commencement of the rainy season, insisted on being allowed to return. This was by no means agreeable to a prince of such a martial disposition as Amda Sion. He therefore told them, that, if they were afraid of rains, he would conduct them to a country where there were none; meaning Adel, which, though likewise within the limits of the tropical rains, has them at another season than that in which they fall in Abyssinia. Thus he persuaded his army again to set forward: but was so grievously harassed by the nocturnal attacks of the Moors, that he was once more in danger of being deserted; and when by his eloquence he had found means to dissipate the apprehensions of the soldiers, he

Excessive
superstition
of both parties.

The king's
troops harassed.

was seized with a violent fever which threatened his life. The soldiers now expected that they were soon to return; but while they indulged themselves in the carelessness which usually attends an expectation of this kind, they accidentally received intelligence that the Moors, having assembled an army of 40,000 men, were in full march to attack them, and at a very small distance. The king was now free from fever, but so weak that he fainted on attempting to put himself in readiness for going out to battle. Still, however, his resolution continued firm and unalterable; having recovered from his faint, washed and refreshed himself, he made a speech to his soldiers, filled with the most enthusiastic expressions of confidence in the justice and goodness of the cause in which he was engaged, and in the continuance of the divine favour and protection. "As it never was my opinion (said he), that it was my own strength and valour, or their want of it, which has so often been the cause of preserving me from their hands; so I do not fear at present that my accidental weakness will give them any advantage over me, as long as I trust in God's power as much as I have ever done." By this speech the drooping spirits of the Abyssinians were revived; and they only begged that their monarch would now trust to the valour of his troops, and not expose his person to such danger as he had usually done. He promised to comply with their request; but matters were soon thrown into confusion by a report that the Moors had poisoned the wells and enchanted all the running water in the front of the army. The poisoned wells, however, were easily avoided; and a priest of vast sanctity was dispatched a day's journey before the army to disenchant the waters by his blessings; which, having the advantage of the good qualities of the element itself on their side, were doubtless more powerful than the spells of the infidels. Not content with this, the king caused a river to be consecrated by the name of *Jordan*; but while his men were employed in bathing themselves in this holy water, the *Fits-Auraris*, an officer who had been dispatched with a party of men who always go before the Abyssinian armies, was attacked and driven back on the main body by a detachment of the enemy, who had along with them a number of women provided with drugs to poison and spells to enchant the waters. A dreadful panic now seized the whole army. Unmindful of the promises made to their king, they not only refused to advance, but for the most part resolved to leave the camp, and return homewards without delay. The king, sensible that all was lost if this pernicious scheme should be adopted, did his utmost to encourage and persuade them to return to their duty; but perceiving that nothing was to be gained by reasoning with men so much terrified, he only requested that such as could not be induced to fight, would not leave their places, but stand quiet spectators of the battle. Even this had very little effect: so that, finding the enemy now ready to make an attack, he ordered his master of the horse with only five others, to attack the left wing of the enemy; while he, with a small party of his servants, made an attack on the right. This desperate action was attended with success. The king, notwithstanding the weakness he yet laboured under, killed with his own hand two of the commanding officers of the enemy's right wing; while his son dispatched another

The king
is seized
with a
dangerous
fever.

His troops
disheartened.

Struck
with a panic,
they refuse to
engage.

He begins
the fight
with a very
few attendants.

Abyssinia. ther of considerable rank belonging to the left. This had such an effect upon the whole Moorish army, that they began evidently to lose courage; while the Abyssinians, ashamed of their conduct, now rushed furiously on to rescue their prince from danger. The battle continued for some time with great obstinacy; but at last the centre and left wing of the Moors were entirely defeated. The right wing, composed principally of Arabians, retired in a body; but not knowing the country, they entered a deep valley surrounded by perpendicular rocks entirely covered with wood. The Abyssinians, imagining they had nothing more to do, began to strip and mangle the bodies of the killed and wounded; but the king, perceiving that the Arabians had brought themselves into a situation from whence they never could be extricated, obliged his soldiers to desist from this barbarous employment, and even killed two of them who disobeyed his orders. The army was then divided into two parts, one of which surrounded the devoted Arabians, while the other was sent a day's journey after the remainder of the Moors. Both parties proved equally successful. The king, with part of his division, attacked the Arabians in front, while the rest rolled great stones down from the tops of the rocks upon them. By this they were thrown into such confusion, that being neither able to fly nor resist, they were all killed to a man. The fate of the Moors was little better. The other division of the Abyssinian army found them lying round a large pool of water, which they lapped like as many dogs. In this helpless situation there was nothing requisite but to order them to be slaughtered; and this cruel order was punctually executed. The soldiers imagining they should now discharge their vow to heaven, wearied themselves with slaughter; till at last, being almost satiated with blood, they made a few prisoners, among whom was Saleh king of Mara, with his queen; the former of whom was hanged by order of Amda Sion, and the latter cut in pieces, and her body given to the dogs by the soldiers.

Amda Sion pursues his advantage. This signal victory was gained in the end of July 1316; but as the rains at that season set in with violence, most of the army now again insisted on their returning home without delay. The king and principal officers, however, were of opinion, that the advantages so dearly purchased ought by all means to be pursued till they had either reduced the Mahometans to subjection, or at least deprived them of all power to make attacks on the empire with any prospect of success. This opinion being adopted, the king sent back the baggage, women, and others who could be of no use to the army; retaining only the veteran soldiers, who were able to encounter more than six times the number of such enemies as he could expect to meet with. Advancing farther into the Mahometan territories, he took up his residence in a large town called *Zeyla*; from whence he, that very night, sent out a detachment to surprise a large village in the neighbourhood named *Taraca*. This was executed with success; the men were massacred, and the women kept to supply the places of those who had been sent away. Continuing still to advance, he detached parties to lay waste the countries all round; and in this expedition he had the good fortune to cut off two of the principal authors of the conspiracy against him. He then proceeded to

invade Talab and Abalge in the territories of the king of Adel. That monarch, now rendered desperate by the view of approaching ruin, had assembled all the troops he could raise, in order to make one last effort against the enemy; but conducted himself with much less prudence than he ought to have done when contending with such an experienced and vigilant adversary. Amda Sion, confident of success, took no less care how to prevent the enemy from escaping than how to gain the victory. For this purpose he dispatched parties of horse to lie in wait in all those avenues by which he supposed that the Moors might attempt to make their escape; after which, falling furiously on the Adeliens himself, and being well supported by his troops, he gained a complete victory; the king of Adel, with great numbers of his men, being killed on the spot, and almost all the rest by the parties of horse whom the Abyssinian monarch had posted in ambush to intercept them. **Abyssinia. Adel invaded.**

As the loss of this battle rendered the affairs of the Adeliens quite desperate, the three young princes, sons of the late king, with their uncle, waited upon Amda Sion with rich presents, which they laid at his feet in the most humble manner, putting their foreheads in the dust, and intreating his pardon; professing their subjection and readiness to obey his commands, provided that he would spare the remainder of their country and property. To this the king made a very unfavourable reply, reproaching them with indignities done to himself; but especially with the sacrilege they had committed in burning churches and murdering priests, destroying also defenceless people in villages, merely because they imagined that he could not protect them. To punish these and other crimes, he said, he was now in the heart of their country; and he was determined never to turn his back upon Adel while he had ten men capable of drawing their swords; for which reason he commanded them to return and expect the approach of his army. **The king of Adel defeated and killed.**

By this fierce speech the brother and two eldest children of the king of Adel were so disheartened, that they could not speak; but the youngest son made a very spirited speech, in which he attempted to soften the king by complimenting his valour, and showing that it was unworthy of his character to push the war against a people who were already conquered and defenceless. All the answer he could obtain, however, was, that unless the queen with the rest of the royal family, and the principal people of the nation, would come by to-morrow evening and surrender themselves as the princes had done, he would lay waste the territory of Adel, from the place where he sat to the Indian ocean. On this the princes earnestly requested their mother to submit without reserve to the clemency of the Abyssinian monarch, and to wait upon him next morning; but she was prevented from this by some of the nobility who had formerly advised the war, and who justly suspected danger to themselves if they should be obliged to submit unconditionally to the conqueror. They resolved, therefore, once more to venture a battle; and the better to ensure success, they bound themselves by an oath to stand by each other to the last extremity. At the same time they dispatched messengers to the princes, requesting them to make their escape with all manner of expedition, and to head the army themselves; all

Are unfavourably received.

The war continues.

Abyssinia. all of whom were determined to conquer or die as soon as the royal family should be out of the enemy's hands. By this conduct the Abyssinian monarch was so much irritated, that he divided his army into three parts; two of which he commanded to enter the territory of the enemy by different routes, and to exterminate both man and beast wherever they came; while he himself, with the third, took the straight road to the place where the new Adelian army was encamped. Here he found a number of infantry drawn up and ready to engage him; but, besides these, there was a multitude of old men, women, and even children, all armed with such weapons as they could procure. Surprised at this sight, he ordered a party of horse to disperse them; but this was found impossible; so that he was obliged to call in the detachments he had sent out, with orders to fall upon the enemy by the nearest way they could advance. The engagement was for a long time very doubtful; and in opposition to Amda Sion appeared the young king of Wyppo, who everywhere encouraged his troops, and made the most obstinate resistance. The Abyssinian monarch having observed him, sheathed his sword, and arming himself with a bow, chose the broadest arrow he could find, and took so just an aim, that he shot the young prince through the side of the neck, and his head inclining to one shoulder he soon fell down dead. On this the spirit of the Adelians entirely forsook them, and they betook themselves to flight; but unluckily falling in with two Abyssinian detachments coming to the king's relief, they were so completely destroyed, that only three of them are said to have made their escape. On the side of the Abyssinians, however, the victory was dearly purchased; many of the principal officers being killed, and scarcely one of the cavalry escaping without a wound.

An obstinate battle.

The Moorish army entirely cut off.

Dreadful devastations.

The royal family not confined as formerly.

Reign of Saif Araad.

The remainder of this expedition consisted only in the destruction and burning of towns and villages, and massacres of helpless people, on pretence of retaliating the injuries committed by the Mahometans against the Christians. At last, weary of conquest and of carnage, this victorious monarch, who never suffered a defeat in any battle, returned in triumph to his capital, where he ended his days after a reign of 30 years. In his time we find that the royal family were not confined, as had been the usual practice from the time of the queen of Sheba to the massacre by Judith; for Saif Araad, the son and successor of Amda Sion, distinguished himself in one of the battles in which his father was engaged.

Though the new prince, as appears from what has been just now observed, was by no means destitute of military talents, the Abyssinian empire enjoyed a profound peace during his reign. The only remarkable transaction was the relief given by him to the Coptic patriarch, whom the sultan of Egypt had thrown into prison. At this time a great trade was carried on through the desert by caravans between Cairo and Abyssinia, as well as from Cairo to Suakem on the Red sea; but the Ethiopic monarch having seized the merchants from Cairo, and sent parties of horse to interrupt the caravans in their passage, the sultan was soon content to release the patriarch, whom he had imprisoned only with a view to extort money.

Of Theodoros. In the reign of Theodoros, who held the crown of Ethiopia from the year 1409 to 1412, we find an in-

fringement made on the treaty between Icon Amlac and the Abuna Tecla-Haimanout formerly mentioned. By that treaty the Abuna was to have a full third of the whole empire for the support of his own dignity and that of the church: but Theodoros, justly considering this as an unreasonable acquisition, reduced it very considerably, though he still allowed a very ample revenue out of every province of the empire; and even this has been considered by several of his successors as far too large, and consequently has been frequently abridged by them. The annals of this prince's reign are very defective, and Mr Bruce supposes that they have been mutilated by the ecclesiastics; which, considering what we have just now related of his reducing their revenues, is by no means improbable. By his subjects he was considered as such a saint, that to this day the people believe he is to rise again and to reign a thousand years in Abyssinia; during which period war is to cease, and happiness to be universally diffused.

Abyssinia.

Is celebrated as a saint.

From the time of Theodoros to that of Zara Jacob, who began his reign in 1434, the Abyssinian annals furnish us with little or nothing of any consequence. The character of this prince is represented as by no means inferior to that of Theodoros, or indeed of any monarch that ever sat on the throne of Ethiopia, or any other kingdom in the world. He is, in short, set forth as another Solomon, and a model of what sovereigns ought to be; though, from some particulars of his reign, his character should seem to be rather exaggerated. The first remarkable transaction of this great monarch was his sending an embassy to the council of Florence. The ambassadors were certain priests from Jerusalem, who in that assembly adhered to the opinions of the Greek church; and the embassy itself was judged to be of such consequence as to be the subject of a picture in the Vatican. This prince obtained also a convent at Rome from the pope for the use of the Abyssinians; which is still preserved, though very seldom visited by those for whom it was designed. He seems to have been very desirous of keeping up a correspondence with the Europeans as well as the Asiatics; and in his time we first read of a dispute in Abyssinia with the *Frangi* or Franks on the subject of religion. This was carried on in presence of the king between one Abba George and a Venetian painter, Francisco de Branco Lone, in which the former confuted and even convinced his antagonist; but from this time we find a party formed for the church of Rome, and which probably took its rise from the embassy to the council of Florence.

Sends an embassy to the council of Florence.

A party for the church formed.

The prince of whom we now treat was the first who introduced persecution on a religious account into his dominions; and for this reason, most probably, he is so highly commended by the ecclesiastics. The state of religion in Abyssinia was now indeed very corrupt. The Greek profession had been originally established from the church of Alexandria; but in the low provinces bordering on the coast of Adel, the Mahometan superstition prevailed. Many of that persuasion had also dispersed themselves through the towns and villages in the internal parts of the empire, while in not a few places the grossest idolatry still took place; such as the worship of the heavenly bodies, the wind, trees, cows, serpents, &c. All this had hitherto passed unnoticed; but in the reign of Zara Jacob, some families

Religious persecution introduced.

Abyssinia. lies being accused of worshipping the cow and serpent, were brought before the king, who pronounced sentence of death upon them. Their execution was followed by a royal proclamation, that whoever did not carry on his right hand an amulet with these words upon it, "I renounce the devil for Christ our Lord," should not only forfeit his personal estate, but be liable to corporeal punishment. The spirit of persecution thus begun, quickly diffused itself, and an inquisitor was appointed to search for criminals. This was one Amda Sion, the king's chief confidant, who pretended to all that absurd and austere devotion common to religious hypocrites. In this he was flattered with uncommon parade and attendance, the usual rewards of people of that stamp; as he never appeared abroad but with a great number of soldiers, trumpets, drums, and other ensigns of military dignity waiting upon him. He kept also a number of spies, who brought him intelligence of those who were secretly guilty of any idolatrous or treasonable practices; after which, proceeding with his attendants to the house of the delinquent, he caused the family first supply himself and his party with refreshments, and then ordered the unhappy wretches to be all put to death in his presence. Among those who suffered in this barbarous manner were the two sons-in-law of the king himself, who had been accused by their wives, the one of adultery, and the other of incest; on which slight ground they were both put to death in their own houses, in such a manner as deservedly threw an odium on the king. His conduct was afterwards so severely condemned by a certain clergyman from Jerusalem, that a reformation seems to have been produced; and no mention is afterwards made of the inquisitor or persecution during this reign.

Amda Sion cruel inquisitor.

Murder of the king's son-in-law.

Persecution suppressed.

The attention of the king was now called off from religion to the state of his affairs in the different provinces of the kingdom. As the Moorish provinces were very rich, by reason of the extensive trade they carried on, and frequently employed their wealth in exciting rebellion, it became necessary that the sovereign himself should examine into the circumstances and dispositions of the several governors; which was likewise proper on another account, that he might assign to each the sum to be paid. On this occasion he divided the empire more distinctly, and increased the number of governments considerably; which being done, he set about repairing the churches throughout the country, which had fallen into decay, or been destroyed in the war with the Mahometans. So zealous was he in this respect, that having heard of the destruction of the church of the Virgin in Alexandria by fire, he instantly built another in Ethiopia, to repair the loss which Christianity might have suffered.

Affairs of the kingdom regulated.

Churches repaired.

The last public transaction of this prince's reign was the quashing of a rebellion which some of his governors had entered into; but whatever glory he might acquire from this or any other exploit, his behaviour with regard to his domestic affairs must certainly place him in a very disadvantageous light. In the decline of the king's life, the mother of the heir-apparent conceived such an extreme desire to behold her son in possession of the throne, that she began to form schemes for obliging his father to take him into partnership with him in the government. These being discovered,

The queen put to a cruel death.

her husband cruelly caused her to be whipped to death: and finding that his son afterwards performed certain solemnities at her grave in token of regard for her, he caused him to be loaded with irons and banished to the top of a mountain; where he would probably have been put to death, had not the monks interfered. These having invented prophecies, dreams, and revelations, that none but the young prince Bæda Mariam was to possess the throne, the old king submitted to the decrees of Heaven, and relaxed in his severity.

Abyssinia.

On the accession of the new king in 1468, the old law for imprisoning all the royal family was revived, and a mountain named *Geshen* chosen for the purpose. Having thus secured himself from any danger of a rival in case he should undertake a foreign expedition, he proclaimed a pardon to all those who had been banished during the former reign, and thus ingratiated himself with his people: after which he began to prepare for war. At this the neighbouring princes, particularly the king of Adel, being alarmed, sent ambassadors requesting the continuance of peace. The Abyssinian monarch told them, that his design was to destroy the Dobas; a race of shepherds very wealthy, but extremely barbarous, professing the Pagan religion, and greatly resembling the Gallas. The reason of his commencing hostilities against them was, that they made continual inroads into his country, and committed the greatest cruelties; on which account he determined not to make war as with a common enemy, but to exterminate and destroy them as a nuisance. The king of Adel was no sooner possessed of this piece of intelligence, than he communicated it to the Dobas; desiring them to send their women and children, with their most valuable effects, into his country, till the invasion should be over. This proposal was readily embraced; but Bæda having got notice of it, seized an avenue through which they must necessarily pass, and massacred every one of the company. After this, entering their country, he committed such devastations, that they were glad to submit, and even to renounce their religion in order to free themselves from such a dreadful enemy. The king then turned his arms against Adel, where he was attended with his usual success; a most complete victory being gained over the Moors by the Abyssinian general: but while the king himself was advancing towards that country, with a full resolution to reduce it to the most abject state of misery, he was seized with a pain in his bowels, which occasioned his death.

The royal family again confined.

War with the Dobas resolved on.

They are massacred.

Death of the king.

The discovery of the kingdom of Ethiopia or Abyssinia by the Europeans took place about this time. It has already been observed, that some intercourse by means of individuals had been carried on betwixt this country and Italy; but the knowledge conveyed to Europeans in this manner was very imperfect and obscure. Even the situation of the country had been forgot; and though some confused notions were entertained of a distant Christian prince who was likewise a priest, Marco Paulo, the famous Venetian traveller, affirms that he had met with him in Tartary; and it was universally agreed, that his name was *Joannes John Presbyter, Prete Janni, or Prester John*. When the Portuguese began to extend their discoveries along the coast of Africa, more certain intelligence concerning this prince was obtained. Bemoy, one of the kings of the

Discovery of Abyssinia by the Europeans.

Of Prester John.

Abyssinia.

Ambassadors sent from the king of Portugal.

Account of their travels.

Important intelligence conveyed to Portugal by Covillan,

Reign of Alexander.

Meditates a war against Adel.

the Jalosses, a nation on the western coast of Africa, had assured the Portuguese navigators of the existence of such a prince so strongly, that the king determined to send ambassadors to him; and the discovery was of the greater consequence, that a passage to the East Indies was now attempted both by land and sea. The ambassadors were named *Peter Covillan* and *Alphonso de Paiva*. These were sent to Alexandria in Egypt, from whence they were to set out on their journey; the intent of which was, to explore the sources of the Indian trade, the principal markets for the spice, &c. but above all, to discover whether it was possible to arrive at the East Indies by sailing round the continent of Africa.

In the prosecution of this scheme our two travellers went from Alexandria to Cairo; from thence to Suez at the bottom of the Red sea; from Suez they took their route to Aden, a wealthy and commercial city beyond the straits of Babel Mandel. Covillan now set sail for India, and De Paiva for Suakem. The latter lost his life without making any discovery; but Covillan passed over to Calicut and Goa. From thence he returned to the continent of Africa, visiting the gold mines of Sofala, and passing from thence to Aden and Cairo; at which place he was informed of the death of his companion. In this city he was met by two Jews with letters from the king of Abyssinia. One of these Jews was sent back with letters to the Abyssinian monarch: but with the other he proceeded to the island of Ormus in the Persian gulf. Here they separated; the Jew returning home, and Covillan repassing the straits of Babel Mandel, whence he proceeded to Aden, and afterwards entered the Abyssinian dominions.

The reigning prince at this time was named *Alexander*; and when Covillan arrived, he was employed in levying contributions upon his rebellious subjects. He met with a kind reception; and was conveyed to the capital, where he was promoted to the highest posts of honour, but never allowed to return to Europe again. The intelligence, however, which he transmitted to the court of Portugal proved of much importance. He not only described all the ports of India he had seen, with the situation and wealth of Sofala, but advised the king to prosecute the discovery of the passage round Africa with the utmost diligence; affirming, that the cape at the southern extremity of the continent was well known in India; and accompanying the whole with a chart which he had obtained from a Moor, and which showed exactly the situation of the cape and neighbouring countries.

Covillan arrived in Ethiopia about the year 1490; and the prince to whom he addressed himself was *Alexander* the son of *Bæda Mariam*, a prince endowed with many good qualities, and no less versed in military affairs than any of his predecessors. His reign was disturbed by plots and rebellions, which at last proved fatal to him. From his early years he manifested a great desire to make war on the king of Adel, who seems to have been the natural rival of the Ethiopic princes. But the Adelian monarch, having now become sensible that he was not able to cope with such powerful adversaries, took the most effectual way of securing himself; viz. by gaining over a party at the court of Abyssinia. In this he had now succeeded so

well, that when Alexander was about to invade Adel, *Za Saluce* the prime minister, with many of the principal nobility, were in the interest of his adversary. Not being apprized of this treachery, however, Alexander intrusted this minister with the command of a great part of his forces; and with these the latter abandoned him in the heat of an engagement. Alexander and the few troops who remained with him, however, were so far from being disheartened by this treachery, that they seemed to be inspired with fresh courage. The king having killed the standard-bearer of the enemy, and thus become master of the green ensign of Mahomet, the enemy began to give way; and on his killing the king of Adel's son, immediately after, they quitted the field altogether. The victory was not by any means complete; neither was Alexander in a situation to pursue the advantage he had gained. Having therefore challenged the Moors to a second engagement, which they declined, he returned with a design to punish his perfidious minister *Za Saluce*, who had endeavoured to excite the governors of all the provinces to revolt as he went along. The traitor, however, had laid his plots too well; so that his sovereign was murdered in two days after his arrival in the capital. *Za Saluce* did not enjoy the rewards he expected from his treachery: for having attempted to excite a revolt in the province of Amhara, he was attacked by the nobility there; and his troops deserting him, he was taken prisoner without any resistance, his eyes were put out, and himself exposed on an ass, to the curses and derision of the people.

Alexander was succeeded by an infant son, who reigned only seven months; after which his younger brother *Naod* was chosen king by the unanimous voice of the people. He proved a wise and virtuous prince; but the late misfortunes, together with the corruption introduced at court by the Mahometans, had so unhinged the government, that it became very difficult to know how to manage matters. Judging very properly, however, that one of the most effectual methods of quieting the minds of the people would be an offer of a general pardon; he not only proclaimed this, but likewise, "That any person who should upbraid another with being a party in the misfortunes of past times, or say that he had been privy to this or that conspiracy, had received bribes from the Moors, &c. should be put to death without delay." On his entering upon government, he found it necessary to prepare against an enemy whom we have not heretofore mentioned, viz. *Maffudi*, prince of a district named *Arar*, which lay in the neighbourhood of Adel. This chieftain being a man of a very enterprising and martial disposition, and a most violent enthusiast in the Mahometan cause, had made a vow to spend 40 days annually in some part of the Abyssinian dominions during the time of Lent. For this purpose he kept a small body of veteran troops, with whom he fell sometimes on one part, and sometimes on another of the frontiers, putting to death without mercy such as made resistance, and carrying off for slaves those who made none. For 30 years he continued this practice; beginning exactly on the first day of Lent, and proceeding gradually up the country as the term advanced. His progress was greatly facilitated by the superstition of the people themselves, who kept that fast with such rigour as almost

Abyssinia. He is deserted by his prime minister and most of his army in battle, but gains a victory.

Alexander murdered.

Maffudi ravages the Abyssinian territories.

Abyssinia. most entirely to exhaust their strength; so that Maffudi having never met with any opposition, was always sure of success, and thus came to be reckoned invincible. On the present occasion, however, he experienced a prodigious reverse of fortune. Naod having enjoined his soldiers to live in the same full and free manner during the fast as at any other time, and having set the example himself, marched out against his enemy; who, being ignorant of the precaution he had taken, advanced with his usual confidence of success. The Abyssinian monarch, still pretending fear, as if on account of the weakness of his men, pitched his camp in very strong ground, but left some passages open to it, that the enemy might make an attack. This was done contrary to the advice of their leader; and the consequence was, that almost every one of them was cut off. On this the king of Adel sent ambassadors to solicit a continuance of the peace with himself; which was granted, upon condition that he restored all the slaves whom Maffudi had carried off in his last year's expedition; with which the Mahometan chief thought proper to comply rather than engage in such a dangerous war.

David III.

Naod having thus freed his country from the danger of any foreign invasion, applied himself to the cultivation of the arts of peace, and reforming the manners of his subjects, in which he spent the remainder of his days. He died in 1508, after a reign of 13 years; and was succeeded by his son David III. a child of 11 years of age. Though the affairs of the empire were at present in such a state as required a very prudent and active administration, the empress Helena, widow of Bæda Mariam, had interest enough to get the crown settled on the infant just mentioned. This proceeded partly from her desire of engrossing all the power into her own hands, and partly from a wish to keep peace with Adel her native country. These ends could not be accomplished but by keeping a minor on the throne of Abyssinia; which was therefore her constant object as long as she lived. But though this might not have been attended with any very bad consequence had the two nations been left to decide the quarrel by themselves, the face of affairs was now quite changed by the interference of the Turks. That people having now conquered almost the whole of Arabia to the Indian ocean, being likewise on the point of reducing Egypt, and having a great advantage over their adversaries in using fire-arms, now projected the conquest of India also. In this indeed they were always disappointed by the superior valour of the Portuguese: but as this conquest remained a favourite object with them, they did not abandon their attempts. In the countries which they had conquered, they exacted such enormous contributions from the merchants, that vast numbers of them fled to the African side of the Red sea, and settled on the coast of Adel. The Turks surprised at the increase of trade in this country, which they themselves had occasioned, resolved to share in the profits. For this purpose they took possession of Zeyla, a small island in the Red sea, directly opposite to the coast of Adel; and erected a customhouse in it, where they oppressed and ruined the trade as in other places. Thus both Adel and Abyssinia were threatened with a most formidable enemy, which it would have been utterly out of their power to have resisted, had not the

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desire of possessing India constantly prevented the Turks from directing their strength against these countries. Helena was sensible enough of the dangerous situation of the empire, but preferred the gratification of her ambition to the good of her country; however, that she might preserve herself from the attacks of such a formidable enemy, it was now thought proper to enter into an alliance with the Portuguese. The ambassador from Portugal, Peter Covillan, was denied the liberty of returning to his own country, as has been already related; and as, for some time past, it had not been obvious how he could be of much use, he had begun to fall into oblivion. The present emergency, however, recovered his importance. The empress was sensible of the necessity she lay under of having some person who understood both the Abyssinian and Portuguese languages before she could open any correspondence with that nation, and who might likewise inform her of the names of the persons to whom her letters ought to be addressed. By him she was now instructed in every thing necessary to the success of her embassy. The message was committed to one Matthew an Armenian merchant, with whom a young Abyssinian was joined; but the latter died by the way. The letters they carried are by Mr Bruce supposed to have been partly the work of Covillan and partly of the less experienced Abyssinian confidants of the empress. They began with telling the king, that Matthew would give him information of her whole purpose, and that he might depend on the truth of what he said: but in the latter part the whole secret of the embassy was disclosed, and a force sufficient to destroy the Turkish power was expressly solicited. Among the other particulars of this embassy also it is said, that a third part of Abyssinia was offered in case her requisitions were complied with; but this, as well as the embassy itself was always denied by David when he came of age.

Matthew, though raised from the rank of merchant to that of an ambassador, could not, it seems, act according to his new dignity in such a manner as to screen himself from the most mortifying and dangerous imputations. Having arrived at Dabul in the East Indies, he was seized as a spy, but relieved by Albuquerque the viceroy of Goa; and that not out of any regard to his character as ambassador, but because he himself had a design upon Abyssinia. This viceroy used his utmost endeavours to induce Matthew to deliver his commission to him; but the ambassador constantly refused to show any letter he had, except to the king of Portugal in person, and in his own kingdom. This put him out of favour with the viceroy; while his attendants, displeased at the mean appearance of the man, insisted sometimes that he was a spy from the sultan, at others that he was a cook, an impostor, or a menial servant. Matthew, however, perceiving that he was now out of danger, maintained that his person was sacred, and insisted on being treated as the representative of a sovereign. He let the viceroy, bishop, and clergy know, that he had with him a piece of the wood of the true cross, sent as a present to the king of Portugal: and he required them, under pain of sacrilege, to pay respect to the bearer of such a precious relic, and to celebrate its arrival as a festival. This was instantly complied with, and a solemn procession instituted; but very little regard

Abyssinia.
An embassy
sent to Portugal.

Abyssinia
in danger
from the
Turks.

Abyssinia. gard appears to have been paid to this ambassador either in his temporal or spiritual character, as he could not obtain leave to depart for Portugal till 1513, which was three years after he arrived in India. In his passage he was extremely ill-treated by the shipmasters with whom he sailed: but of this they soon had cause to repent; as on their arrival at Lisbon they were all put in irons, and would probably have died in confinement, had not Matthew made intercession for them with the king.

Maffudi renews his depredations.

In the mean time, Maffudi having recovered from the defeat given him by Naod, and formed alliances with the Turks in Arabia, had renewed his depredations on the Abyssinian territories with more success than ever. Such a number of slaves had been, by his assiduity, sent to Mecca, that he was honoured with a green silk standard (an emblem of the true Mahometan faith), with a tent of black velvet embroidered with gold, and he was likewise made Sheykh of Zeyla; so that, as this island was properly the key to the Abyssinian empire, he could neither be rewarded with greater honour nor profit. This happened when David had attained the age of 16; and in consequence of such surprising success the king of Adel, never a hearty friend to Abyssinia, determined to break the peace with that empire and make an alliance with Maffudi. Having taken this resolution, the two princes invaded Abyssinia with their joint forces, and in one year carried off 19,000 Christian slaves, so that a general terror was spread over the whole empire. David, already impatient of the injuries his people had sustained, determined to raise an army, and to head it in person as his ancestors had done, contrary to the advice of the empress, who considering only his youth and inexperience in military affairs, wished him to have employed some of his veteran officers. A very powerful army was raised, and ample supplies of all kinds were procured. With one part of his forces the emperor took the road to Aussa the capital of Adel; sending the other under the command of an officer named the *Betwudet*, to meet the Moorish army, which was then ravaging part of Abyssinia. It was natural to be imagined, that the Moors, on hearing that an army was marching to destroy the capital of their country, would abandon the thoughts of conquest or plunder to preserve it. In doing this, David knew that they had certain defiles to pass before they could reach Adel. He ordered the *Betwudet* therefore to allow them to enter these defiles; and before they could get through, he himself, with the main body of the army, marched to attack them at the other end. Thus the Moors were completely hemmed in by a superior army: but besides this unfavourable situation, they were farther dispirited by Maffudi. That hero came, on the morning of the engagement, to the king of Adel, informing him that his own time was now come; that he had been certainly told by a prophet, long ago, that if this year (1516) he should fight the king of Abyssinia in person, he should lose his life. He was assured that the Abyssinian monarch was then present, having seen the scarlet tent which was used only by the sove-

David marches against him.

Maffudi prophesies his own death.

reigns of that country; and therefore advised the king of Adel to make the best of his way over the least steep part of the mountain before the engagement began. The Adelian monarch, who had at any rate no great inclination to fight, was not inspired with courage by this speech: he therefore followed the advice given him; and, with a few of his friends, passed the mountain, leaving his troops to their fate. The Moors, in the mean time, being abandoned by one leader, and having another devoted to destruction, showed an uncommon backwardness to engage, which was taken notice of by their enemies. Maffudi, however, as soon as he supposed the king of Adel to be out of danger, sent a trumpet to the Abyssinian camp, with a challenge to any man of quality in the army to fight him; on condition that the party of the victorious champion should be accounted conquerors, and that the armies should immediately separate without further bloodshed. The challenge was instantly accepted by a monk named *Gabriel Andreas*; who, in the reign of Bæda Mariam, had been condemned to lose the tip of his tongue for speaking slightly of the king's proclamation of amnesty. Maffudi showed no reluctance to present himself; but received such a stroke from his antagonist with a two-handed sword as almost cut his body in two, and he immediately fell down dead. Andreas cut off his head; and throwing it at the king's feet, cried out, "There is the Goliath of the infidels." This became the signal for a general engagement, notwithstanding the terms stipulated by Maffudi before the combat. The Moors were quickly repulsed by the king's troops, and driven backward through the defile. At the other end they were met by the *Betwudet* (B), who drove them back to the king's forces; so that at last being forced to fly to the mountains, they were all slaughtered by the peasants, or perished with hunger and thirst.

He is killed.

The Moors defeated and destroyed.

The same day that this victory was gained over the Moors by David, being in the month of July 1516, the island of Zeyla in the Red sea was taken and burnt by the Portuguese fleet under Lopez Suarez de Alberguiera. The Abyssinian ambassador, Matthew, in the mean time, had been received with the greatest marks of esteem in Portugal. The utmost attention was paid to his embassy; he was lodged in the most splendid manner; and his maintenance was suitable to his lodging. The king prepared an embassy on his part, and sent home Matthew on board the Indian fleet commanded by Lopez. The ambassador ordered for Abyssinia was one Edward Galvan, a man who had filled many state departments with the utmost applause; but who by reason of his age, being now 86, was certainly very unfit for such a distant and perilous voyage. He died accordingly on the island of Camaran in the Red sea, where Suarez had imprudently landed, and passed the winter in the utmost distress for want of provisions of every kind. This admiral was succeeded by Lopez de Seguyera; who sailed first to the island of Goa in the East Indies, where he fitted out a strong fleet; after which he returned to the Red sea, and landed on the island of Masnah, having

Zeyla taken by the Portuguese.

Embassy from the king of Portugal.

(B) This is the title of one of the officers in Abyssinia, not the proper name of a man.

Abyssinia. ing along with him Matthew, about the authenticity of whose mission there had been such disputes. At his first approach the inhabitants fled; but at last he was accosted by a Christian and a Moor from the continent, who informed him that the coast opposite to Masuah was part of the kingdom of Abyssinia, and that it was governed by an officer named the *baharnagash*; that all the inhabitants of the island were Christians; that the reason of their flying at the sight of the Portuguese fleet was that they took them for Turks, who frequently made descents, and ravaged the island, &c. The admiral dismissed them with presents; and soon after had a visit from the governor of Arkceko, a town on the continent; who informed him, that about 24 miles up the country there was a monastery, seven of the members of which were now deputed to wait upon him. These instantly knew Matthew, and congratulated him in the warmest manner upon his return from such a long voyage. An interview soon took place between the *baharnagash* himself and Lopez. The Abyssinian informed him, that the coming of the Portuguese had been long expected, in consequence of certain ancient prophecies; and that he himself and all the officers of the emperor were ready to serve him. They parted with mutual presents; and all doubt about Matthew being now removed, he prepared to set out for the emperor's court; while Roderigo de Lima was nominated ambassador in place of Galvan who died. Along with them were 15 Portuguese; all men of the most determined courage, and who would hesitate at nothing which they thought might contribute to the glory of their king, their own honour, or the advantage of their country. Their present journey indeed was much more perilous than their voyage from Portugal to Abyssinia. The emperor was at this time in the southern part of his dominions, but the Portuguese had landed on the northern part; so that they had almost the whole breadth of the empire to pass before they could meet with him. The very first journey they attempted was through a wood so thick that it could scarce afford a passage either to man or beast, while the interstices of the trees were so interwoven with briars and thorns of various kinds, that their passage was rendered almost impracticable. This was rendered still more terrible by the vast numbers of wild beasts they saw, and which seemed only to be prevented from devouring them by the appearance of so many men together. The rainy season was also now begun; so that they were exposed to incessant deluges of water descending from the clouds, besides frequent and violent storms of wind, thunder, and lightning, &c. To add to their misfortunes, an epidemic fever broke out among them, which carried off Matthew and one of the servants of Don Roderigo. At last, after a most tedious and toilsome journey, from the 16th of April to the 18th of October 1520, the Portuguese ambassador, with his retinue, came within sight of the Abyssinian camp at the distance of about three miles. His reception was by no means favourable; for instead of being immediately admitted to the presence of the emperor, he was waited on by one of the officers of state, styled, in token of humility, *Hadug Ras*, or *commander of asses*; who caused him pitch his tent three miles farther off from the camp: and it was not till five years afterwards that he was enabled to finish the business

of his embassy, and obtained leave to depart for Portugal.

During all this time, not a single word had passed relating to the affairs of the two nations; so that it is difficult to imagine what might have been the design of the Abyssinian emperor. At last, having resolved to send an embassy to Portugal, he allowed Roderigo to depart, but detained two of his people; appointing Zaga Zaab, an Abyssinian monk, his ambassador to Portugal.

This long intercourse betwixt two such distant nations, however, could not but greatly alarm the Mahometan powers, who were natural enemies to both. Selim, the Turkish sultan, having been constantly defeated by the Portuguese in the east, and alarmed at the thoughts of having a fleet of that nation in the Red sea, where they might greatly annoy his settlements on the coast of Arabia, determined to carry his arms to the African side; while the king of Adel, having strengthened himself by alliances with the Turkish officers in Arabia, was now become a much more formidable enemy than before. This was soon experienced in a battle with the Adeliens; in which the Abyssinian monarch was overthrown with the loss of almost all his great officers and principal nobility, besides a vast number of private men. The victory was principally owing to the assistance given by the Turks; for the army was commanded by Mahomet surnamed *Gragné*, i. e. *left-handed*, governor of Zeyla, which had now received a Turkish garrison. This man, having the conquest of Abyssinia greatly at heart, resolved, as soon as possible, to effect something decisive; and therefore having sent to Mecca all the prisoners taken in his late expedition, he obtained in return a considerable number of janizaries, with a train of portable artillery. Thus the fortune of the war was entirely decided in favour of the Adeliens and Turks; the emperor was defeated in every battle, and frequently hunted from place to place like a wild beast. The Moors, finding at last no necessity for keeping up an army, overran the whole empire in small parties, everywhere plundering and burning the towns and villages, and carrying off the people for slaves.

This destructive war continued till the year 1537; when Gragné sent a message to the emperor, exhorting him not to fight any longer against God, but to make peace while it was in his power, and give him his daughter in marriage: on which condition he would withdraw his army; but otherwise he would reduce his empire to such a state that it should be capable of producing nothing but grass. David, however, still refused to submit; replying, that he put his confidence in God, who at present only chastised him and his people for their sins; but that Gragné himself, being an infidel, and enemy to the true religion, could not fail of coming in a short time to a miserable end. This unsuccessful negotiation was followed by several encounters, in which the emperor was constantly defeated; in one of them his eldest son was killed, and in another his youngest was taken prisoner; so that he now seemed entirely destitute, being obliged to wander on foot, and all alone, hiding himself throughout the day among the bushes on the mountains.

The invincible constancy with which this forlorn monarch bore his misfortunes, proved a matter of surprise

Abyssinia. prise both to friends and enemies. Many of his veteran soldiers, compassionating the distresses of their sovereign, sought him out in his hiding places; so that he once more found himself at the head of a small army, with which he gained some advantages that served to keep up his own spirits and those of his adherents. His greatest enemy was Ammer, one of Gragné's officers, who headed the rebellious Abyssinians, and who had formed a scheme of assassinating the king; but, instead of accomplishing his purpose, he himself was assassinated in 1538 by a common soldier, on what account we are not informed.

A new embassy to Portugal.

By the death of Ammer and the small successes which David himself had obtained, the affairs of Abyssinia seemed to revive; but still there was no probability of their being ever brought to a fortunate issue. An embassy to Portugal was therefore thought of in good earnest, as the mischievous effects of slighting the proffered friendship of that power were now sufficiently apparent. One of the attendants of Roderigo, named John Bermudes, who had been detained in Abyssinia, was chosen for this purpose; and to his temporal character of ambassador was added that of Abuna, primate or patriarch. John, who was not a clergyman originally, had received all the inferior ecclesiastical orders at once, that the supreme one might be thus conferred upon him; but happening to be a great bigot to the popish religion, he would not accept of his new dignity but with a proviso, that his ordination should be approved by the pope. This was indirectly submitting the church of Abyssinia to that of Rome; to which David would never have agreed, had it not been for the desperate situation of his affairs at that time. John was therefore allowed to do as he thought proper: when passing through Arabia and Egypt to Italy, he had his ordination confirmed by the pope; after which he set out on the business of his embassy. On his arrival at Lisbon, he was acknowledged by the king as patriarch of Alexandria, Abyssinia, and of the sea; for this last title had also been conferred upon him by his Holiness. Entering then upon the purpose of his embassy, he began by putting Zaga Zaab in irons for having wasted so much time, and done nothing effectual since he had left Abyssinia. Then he represented to the king the distresses of the Abyssinians in such a strong light, and insisted so violently for relief to them, that an order was very soon procured for 400 musketeers to be sent by Don Garcia de Noronha to their relief.

A body of Portuguese ordered to assist the emperor.

To accelerate the progress of the intended succours, John himself proposed to sail in the same fleet with Don Garcia; but his voyage was delayed for a whole year by sickness, occasioned, as he supposed, by poison given him by Zaga Zaab, the monk whom he had imprisoned, and who had been set at liberty by the king. After his recovery, however, he set sail for India, where he arrived in safety. The death of Don Garcia, which happened in the mean time, occasioned another delay; but at last it was resolved, that Don Stephen de Gama, who had succeeded to Don Garcia, should undertake an expedition to the Red sea, in order to burn some Turkish galleys which then lay at Suez. But intelligence having in the mean time been received of the intended voyage, these vessels had withdrawn themselves. Anchoring then in the port of Masuah, Don Stephen sent over to

Arkeeko on the continent to procure fresh water and other provisions; but the Turks and Moors being now **Abyssinians** entirely masters of that coast, the goods he had sent in **The succours arrive and take the town of Arkeeko.** exchange were seized without any thing being given in return. A message was brought back, importing that the king of Adel was now master of all Ethiopia, and consequently, that no trade could be carried on without his leave; but if Don Stephen would make peace with him, the goods should be restored, a plentiful supply of water and all kinds of provisions granted, and amends likewise made for 600 Portuguese who had been killed at Zeyla. These had run away from the fleet on its first arrival in the Red sea, and landed on the coast of Adel, where they could procure no water; of which the barbarians took advantage to decoy them up the country; where, having persuaded them to lay down their arms, they murdered them all. To this Don Stephen returned a smooth answer, sent more goods, obtained provisions, and promised to come ashore as soon as a Mahometan festival, which the savages were then celebrating, should be over. This treaty was carried on with equal bad faith on both sides; but Don Stephen had now the advantage by obtaining the provisions he stood in need of. These were no sooner brought on board, than he strictly forbade all intercourse with the land; and choosing out 600 men, he attacked the town of Arkeeko, killed the governor, and sent his head to the Abyssinian court; massacring at the same time all the people in the town he met with.

During this long interval, a considerable change **Affairs of Abyssinia during this interval.** had taken place in the Abyssinian affairs. We have already seen that David had been reduced to great distress; but afterwards met with some little successes, which seemed to indicate an approaching change of fortune. In these, however, he was soon disappointed. A Mahometan chief called *Vizir Mugdid* made an attack upon the rock Geschen, where the royal family were kept; and finding it entirely unguarded, ascended without opposition, and put every person to the sword. This last disaster seems to have been too great for the resolution even of this heroic prince, as he died the same year, 1540. He was succeeded by his son **Death of David, and accession of Claudius to the empire.** Claudius, who, though then but about 18 years of age, was endowed with all the great qualities necessary for managing the affairs of the empire in such a dreadful crisis, and had made considerable progress before the arrival of the Portuguese.

On his accession, the Moors, despising his youth, instantly formed a league among themselves to crush him at once; but, like almost all others too confident of victory, they neglected to take the proper precautions against a surprise. This was not unobserved by Claudius; who falling upon one party which lay next to him, gave them a total defeat. The king pursued them the whole day of the engagement, the ensuing night, and part of the following day; putting to death without mercy every one who fell into his hands. This excessive ardour very much damped the spirits of his enemies, and at the same time inspired his own party with the most sanguine hopes of success; whence he soon appeared at the head of such an army as convinced his enemies that he was by no means to be despised. They now found it necessary to desist from the practice they had so long continued, of plundering and ravaging

A powerful league formed against the new emperor.

The Moors defeated.

Abyssinia ravaging the country; to call in their scattered parties, unite their troops, and spend the rainy season in such parts of Abyssinia as they had conquered, without returning into Adel, as had hitherto been usual with them. They now came to a resolution to force the king to a general engagement, in which they hoped to prove victorious by dint of numbers. For this purpose all the rebel chiefs in Abyssinia were called in, and a formidable army collected. They waited only for one very experienced chief named *Jonathan*; after whose junction they determined to attack the royal army without delay. But *Claudius* took his posts at all times with such judgment, that any attempt upon his camp would have been almost desperate: and getting intelligence where *Jonathan* lay with his forces, he marched out in the night time, came upon him quite unprepared, defeated and killed him, sending his head to the rest of the confederacy by a prisoner, the only one he had spared out of all those who were taken. By the same messenger a defiance was sent to the Moors, and many opprobrious epithets were bestowed upon them; but though the armies approached one another, and continued for several days under arms, the Moors were so much intimidated that they would by no means venture an engagement.

Jonathan a rebel chief, defeated and killed.

Unsuccessful attempt to assassinate *Claudius*.

By this victory the spirits of the Abyssinians were so much elevated, that they flocked in from all parts to join their prince; and even many of the Mahometans, having experienced the lenity of the Christian government, chose rather to submit to *Claudius* than to the Turks and Adeliens. The king, however, was in danger of being assassinated by one *Ammer*, a treacherous governor; who knowing that he had retired to some distance from his army to celebrate the festival of Easter, attempted to surprise him when almost destitute of attendants; but *Claudius* having timely notice of his designs, laid an ambush for him with a considerable part of his army which he headed in prison. The rebel, not being equally well informed, fell into the snare, was defeated, and almost his whole army cut off on the 24th of April 1541.

Such was the situation of affairs when the Portuguese arrived. The head of the governor of *Arkeeko* had been received by the queen, who regarded it as a happy instance of the valour of her allies, and as a presage of future victories. The Portuguese admiral, *Don Stephen de Gama*, lost no time in employing the men allowed by the king to assist the Abyssinians. These were in number 450; but as the officers who commanded them were all noblemen of the first rank, the army was considerably increased by the number of of their servants. The supreme command was given to *Don Christopher de Gama* the admiral's youngest brother. Almost every man on board, however, was ambitious to share in the glory of this enterprise; whence great complaints were made by those who were not allowed to go: and hence, *Mr Bruce* informs us, the bay in the island of *Masuah*, where the admiral's galley rode, had the name of *Bahia dos Agravados*; the bay of the injured, not of the sick, as has been erroneously supposed.

Derivation of the name of a bay in *Masuah*. The Portuguese under *Don Christopher de Gama* set out to meet the emperor.

This gallant army instantly set forward by the most easy road through the Abyssinian territories, in order to join the emperor. Still, however, the way was so rugged, that the carriages of their artillery gave way,

and they were therefore obliged to construct new ones as they went along, splitting the barrels of old muskets to furnish them with iron, which was extremely scarce in Abyssinia. In this journey the general was met by the empress, attended with her two sisters and a great many others of both sexes, whom he saluted with drums beating and colours flying, accompanied by a general discharge of the fire-arms, to their great confusion and terror. Her majesty, whose person was entirely covered, indulged the Portuguese general with a view of her face; and after a mutual exchange of civilities, the queen returned with 100 musketeers appointed by him as her guard. After eight days march, through a very rugged country, *Don Christopher* received a defiance in very insulting terms from *Gagné* the Mahometan general, which was returned in the same style. An engagement took place on the 25th of March 1542; in which little was done by either party besides wounding both the commanders: however, *Gagné*, though greatly superior in horse, had already felt so much of the Portuguese valour, that he did not choose to venture a second battle.

Abyssinia. Interview with the empress. Battle between the Portuguese and the Moors.

As the season was now far advanced, the Portuguese put themselves into winter-quarters; while *Gagné* remained in their neighbourhood, in hopes of forcing them to a battle before they could be joined by the king, who advanced for the purpose as fast as possible. This being the case, it was to the last degree imprudent in *Don Christopher* to think of venturing an engagement without previously forming a junction with his royal ally; especially as *Gagné* had now doubled the number of his horse, increased his train of artillery, and otherwise received considerable reinforcements. Unfortunately, however, the Portuguese general suffered himself to be hurried away by the impetuosity of his own temper; and paying regard to the defiances and reproaches of a barbarian whom he ought to have despised, was induced, contrary to all advice that could be given, to venture an engagement at a vast disadvantage. Yet when the armies encountered each other, the superiority of the Portuguese was so great, that victory seemed likely to be decided in their favour. On this *Gagné* ordered some artillery to be pointed against the Abyssinian allies. These, entirely unaccustomed to fire-arms, fled almost at the first discharge. *Gagné*, well knowing that it was his interest to destroy the Portuguese, who were only 400 in number, ordered no pursuit against the Abyssinians, but fell with his whole force upon the Europeans. Even yet his success was doubtful, till *Don Christopher*, exposing himself too much, was singled out and shot through the arm. This produced such confusion, that a total defeat, with the loss of the camp, ensued; when the barbarians, according to custom, put to death all the wounded, and began to abuse the women, who had all retired into the tent of the general. This being observed by a noble Abyssinian lady married to one of the Portuguese, she set fire to some barrels of gunpowder which happened to be in the tent, and thus perished along with her ravishers.

Don Christopher, who by his rashness had occasioned this disaster, obstinately refused to fly, till he was put into a litter by force, and set off along with the queen and patriarch, who happened to be present. The two latter had set off before the battle; but *Don Christopher*

Don Christopher rashly engages at a disadvantage. Is wounded and defeated.

Abyssinia.

Takes shelter in a cave, is taken, and put to death.

Gragné, abandoned by his allies, is defeated and killed.

Joram a rebel chief defeated and killed

pher sent some horsemen in pursuit of them, by whom they were brought back, and reproached by the general for the bad example they had shown to the army. Arriving at the approach of night in a wood where there was a cave, Don Christopher entered it to have his wound dressed, but obstinately refused to proceed farther. Next day he was taken; betrayed, as is most probable, by a woman whom he loved; who is said to have pointed out this cave to him, and promised to send some friends to convey him into a place of safety. Instead of this, a party of the enemy entered the cave; and on his readily informing them of his name, they instantly carried him in triumph to Gragné. Here, after several insults had passed on both sides, the barbarian, in a fit of passion, cut off his head; which was sent to Constantinople, and his body cut in pieces and dispersed through Abyssinia.

This cruelty of Gragné proved more detrimental to his cause than a complete victory gained by the other party could have been. On the one hand, the Portuguese were so exasperated by the loss of their leader, that they were ready to embark in the most desperate undertakings, in order to revenge his death; on the other, the Turks, on whom he principally depended, were irritated to the last degree at the disappointment of sharing his ransom, which they imagined would have been an immense sum; and therefore abandoned their leader to return to their own country. Gragné, thus left to decide the quarrel with his Africans, was quickly defeated by Claudius; and in another engagement which took place on the 10th of February 1543, his troops were defeated and himself killed. This last misfortune was owing to his boldness in advancing before his army which was giving way, so that he became known to the Portuguese. On this he was singled out by a Portuguese named *Peter Lyon*, who had been valet de chambre to Don Christopher. This man, to make his aim more sure, crept for a considerable way along the bank of a river towards the place where Gragné was; and when come sufficiently near, shot him quite through the body. Finding himself mortally wounded, he quitted the field of battle; and was followed by Lyon, who in a short time saw him fall from his horse. He then came up to him, and cut off one of his ears, which he put in his pocket and returned to the battle to do what further service he could. The next day Gragné's body was found by an Abyssinian officer, who cut off his head and claimed the merit of killing him; but Lyon having pulled out the ear which he carried in his pocket, vindicated his own right to the reward which was to be given to the other. On this occasion the Moorish army was almost entirely destroyed; Gragné's wife and son were taken prisoners, with Nur the son of Mugdid, who destroyed the royal family; and it had been happy for Claudius, as we shall afterwards see, that he had put these prisoners to death. Very soon after this engagement, the emperor had intelligence that Joram, a rebel chief who had once reduced his father David to great distress, was advancing rapidly in hopes of being still able to be present at the battle. This was the last of his father's enemies on whom Claudius had to revenge himself; and this was effectually done by a detachment of his army, who posted themselves in his way, fell up-

on him unexpectedly, and cut him in pieces with all his men. Abyssinia,

Claudius being now freed from all apprehension of foreign enemies, began to turn his thoughts towards the reparation of the damages occasioned by such a long war, and the settlement of religious affairs. We have already mentioned, that John Bermudes was appointed by the Pope, as he said, patriarch of Alexandria, Abyssinia, and of the sea. This, however, is said by others to have been a falsehood; that John was originally ordained by the old patriarch of Abyssinia; and that the Pope did no more than give his sanction to this ordination, without adding any new one of his own. But whether this was so or not, certain it is, that John, who was very insolent in his behaviour, and of a turbulent disposition, now began to insist that Claudius should not only embrace the doctrines of the church of Rome, but establish that religion throughout the empire, which he said his father David had engaged to do; and which, considering the extreme distress in which he was involved, it is very probable that he did. Claudius, however, was of a different opinion, and refused to alter the religion of the country; upon which a contention began, which was not ended but by the total expulsion of the Catholics, and the cutting off all communication with Europeans. At that time the Portuguese and Abyssinians intermarried, and attended religious worship promiscuously in each others churches; so that the two nations might have continued to live in harmony, had it not been for the misbehaviour of Bermudes. Claudius, perceiving the violence and overbearing disposition of the man, took every opportunity of showing his attachment to the Alexandrian or Greek church; denying that he had made any promise of submitting to the see of Rome. On this Bermudes told him that he was accursed and excommunicated; the king in return called him a Nestorian heretic; to which Bermudes replied by calling him a liar, and threatened to return to India, and carry all the Portuguese along with him. To this insolent speech Claudius answered, that he wished indeed that Bermudes would return to India; but that he would not allow the Portuguese, nor any person, to leave his territories without permission. Disturbances on affairs of religion.

Thus matters seemed likely to come to an open rupture; and there can be no doubt that the worst extremities would have followed, had not the emperor been restrained by the fear of the Portuguese valour on the one hand if he should attempt any thing against them, and the hopes of further advantages should he retain them in his service. For these reasons he bore with patience the insults of the patriarch; attempting to gain the rest of the Portuguese over to his side. He succeeded perfectly with their commander Arius Dias, who privately renounced the church of Rome, and was baptized into that of Abyssinia by the name of *Marcus* or *Marco*; in consequence of which, the emperor, looking upon him as a naturalized subject, sent him a standard with the Abyssinian arms to be used instead of those of Portugal. This, however, was not delivered; for a Portuguese named *James Brito*, meeting the page who carried it, took it from him and killed him with his sword. The apostasy of Arius is said to have been owing to the great honours which had been conferred upon Altercation betwixt the emperor and the patriarch Bermudes.

Abyssinia. upon him by the Abyssinian monarch: for having, in an expedition against Adel, defeated and killed the king, and taken the queen prisoner, he bestowed her in marriage on Arius; and that the match might be equal, he raised him also to the royal dignity, by giving him the kingdoms of Doar and Belwa.

He is interested with royal dignity.

Hostilities between the Abyssinians and Portuguese.

The altercation on the subject of religion becoming every day more violent, Bermudes was prohibited by the emperor from sending any farther orders to the Portuguese, they being now under the command of Marco the Abyssinian captain-general; meaning Arius Dias, to whom the name of Marco had been lately given. To this the patriarch replied, that being subjects of the king of Portugal, they were under no obligation to obey a traitor to his king and religion; and that since his majesty still persisted in refusing to submit to the pope, he was resolved to leave the empire with his forces. The emperor, however, still insisted that he was absolute in his own dominions; and he expected the Portuguese to pay obedience to his general, and none else. The Portuguese, enraged at this declaration, resolved to die sword in hand rather than submit to such terms; and therefore began to fortify their camp in case of any attack. The emperor on this, thinking a defiance was given him in his own territories, ordered the camp to be instantly attacked. The attempt was accordingly made, but with very little success; the Portuguese having strewed the ground with gunpowder, set fire to it as the Abyssinians marched along, which destroyed great numbers, and intimidated the rest to such a degree that they instantly fled. Finding it in vain to think of reducing them by force, the emperor is then said to have been advised by Marco to consult his own safety, and break the power of the Portuguese by artifice. With this view he sent for the patriarch, pretended to be very sorry for his frequent breach of promise, and desirous to make what amends for it he could. Instead of complying with the patriarch's demands, however, he first ordered his subjects to supply them with no provisions: then he stopped the mouths of the Portuguese by a considerable quantity of gold, giving the patriarch himself a very valuable present; adding to all this a large supply of provisions; but at the same time taking proper methods to disperse their leaders into different parts of the empire, so that they should find it impossible ever to reunite in a body.

Such is the account given of this transaction by the Portuguese historians; but that of Mr Bruce, who says that he translated his from the Abyssinian annals, is somewhat different. He only informs us, that the quarrel betwixt the Portuguese and Abyssinians was inflamed by the "incendiary spirit of the brutish Bermudes: from reproaches they came to blows; and this proceeded so far, that one night the Portuguese assaulted the king's tent, where they slew some and grievously wounded others." The event, however, was, that no absolute quarrel ever took place betwixt this emperor and any of the Portuguese, excepting this patriarch, whom he was on the point of banishing to one of the rocks used as prisons in Abyssinia. This was dispensed with on the interposition of Gaspar de Suza the new Portuguese commander (who had succeeded Arius Dias), and another named *Kasmati Robel*, both of whom were in great favour with the emperor; and

Bermudes persuaded to withdraw to India. According to Mr Bruce he repaired to Dobarwa, where he remained two years quite neglected and forlorn, saying mass to no more than ten Portuguese who had settled there after the defeat of Don Christopher. He then went to Masuah; and the wind soon becoming favourable, he embarked in a Portuguese vessel, carrying with him the ten persons to whom he had officiated as priest. From Goa he returned to Portugal, and continued there till his death. On the other hand, the Portuguese writers inform us, that he was narrowly watched by order of the emperor; and that Gaspar de Suza, the Portuguese commander, had orders to put him to death if he should attempt to make his escape. Bermudes, however, being determined at all events, to make his escape, pretended to be ill of the gout, and that a change of air was necessary for his recovery; for which reason he went to the town above mentioned, where there was a monastery. On this pretence he was allowed to cross the kingdom of Tigré, accompanied by eight faithful servants, with whom he reached Dobarwa unsuspected. Here he remained concealed in a monastery for two years before he could find an opportunity of getting to the island of Masuah, from whence he proceeded to Goa.

Abyssinia. Bermudes leaves Abyssinia.

The emperor was scarce freed from this troublesome A new dispute, when he was in danger of being involved in new difficulties by the intrusion of others into his dominions. Ignatius Loyola, founder of the order of the Jesuits, was at that time at Rome; and so much attached to the cause of the pope, that he proposed to go in person to Abyssinia, in order to make a thorough conversion of both prince and people. His holiness, however, who, from what he had already seen of Ignatius, conceived that he might be of greater use to him by staying in Europe, sent in his stead Nugnez Baretto, one of the society of Jesuits, whom he invested with the dignity of patriarch, and honoured with a letter to Claudius. With these commissions, and a number of priests, Baretto sailed for Goa in the East Indies; by which, however distant, the only passage to Abyssinia was at that time. On his arrival at that place he was informed that the Abyssinian monarch had such a steady aversion to the church of Rome, that there was no probability of his meeting with a favourable reception. For this reason it was judged more proper to send some clergymen of inferior dignity, with proper credentials, as ambassadors to the emperor from the governor of India, without running the risk of having any affront put upon the patriarch. These were Oviedo bishop of Hierapolis, Carneyro bishop of Nice, and several others, who arrived safely at Masuah in the year 1558. Claudius, on hearing of their arrival, was greatly pleased, as supposing that a new supply of Portuguese soldiers was arrived. Finding, however, that they were only priests, he was very much mortified, but still resolved to give them a civil reception. But a more important consideration, and which concerned the welfare of the empire in the highest degree, now claimed his attention. This was the appointment of a successor to the throne, Claudius himself having no son. A project was therefore set on foot for ransoming Prince Menas, the emperor's youngest brother, who had been taken prisoner by the Moors in the time of David, and hitherto detained in captivity on a high mountain in Adel.

A new dispute from the Pope.

Prince Menas, as re-deemed from captivity.

This

Abyssinia. This was not likely to be accomplished; for the Moors would not willingly part with one who they knew was their mortal enemy, that he might be raised to the sovereignty of a great empire. By detaining him prisoner also, they might reasonably hope for disputes concerning the succession to the Abyssinian throne; which would enable them to attack the empire with advantage. In these circumstances, it is probable that Claudius would have found great difficulty in procuring his brother's liberty, had it not been that the son of the famous Gragné had been taken in that battle in which his father was killed, and in like manner confined on a mountain in Abyssinia. A proposal was then made to his mother, who had escaped into Athara, that her son should have his liberty, provided the king's brother should be restored. This was accepted; and by means of the bashaw of Masuah, an exchange was made. Four thousand ounces of gold were given for the ransom of Menas, which were divided between the Moors and the bashaw of Masuah; while on his part Claudius set at liberty Ali Gerad the son of Gragné without any farther demand.

Nur determines to destroy Claudius.

According to Bermudes's account of these times, the widow of Gragné was taken prisoner at the battle in which her husband was killed, and was afterwards married to Arius Dias. In this case we must suppose her to have been the same with the *queen of Adel*, mentioned as his consort by other historians: but Mr Bruce treats this account as a mere fable; and informs us, that by means of Nur the son of Mugdid, murderer of the royal family as already related, she made her escape into Athara. On that occasion Nur fell in love with her; but she refused to marry any man unless he brought her the head of Claudius, who had killed her former husband. To attain his wishes, therefore, Nur, now governor of Zeyla, undertook the task; and when Claudius marched towards Adel, sent him a challenge to fight; telling him that there was yet a particular instrument for shedding the blood of the Abyssinian princes, and desiring him to be prepared, as he was very soon to set out to attack him. The emperor did not decline the combat, but is said to have been advised against this expedition by all his friends. This advice seems to have proceeded from a number of prophecies, probably trumped up by the clergy, that he should be unfortunate, and lose his life in the campaign. These prophecies ought no doubt to have had weight with him, as they most certainly indicated a spirit of disaffection among his troops; and the event accordingly evinced that it was so. The Abyssinians fled almost on the first fire, leaving the king in the midst of his enemies, attended only by 18 Portuguese and 20 horsemen of Abyssinia, who continued faithful to the last. All these were killed after the most desperate resistance; the king himself receiving upwards of 20 wounds before he fell. His head was cut off, and brought by Nur to his mistress, who hung it up on a tree before her door. Here it remained for three years, when it was at last bought by an Armenian merchant, who buried it at Antioch in the sepulchre of a saint of the same name. Nur gained on this occasion a very complete victory; the king and most of the principal nobility being killed, a great number made prisoners, and the camp taken with an immense booty. On his return to Adel, he refused to accept of any

Defeat and death of the emperor.

congratulations, or to allow rejoicings to be made for his victory, but passed along in the habit of a common soldier, mounted on an ass; saying, that he owed the victory to the mercy of God alone, who had immediately interposed for the destruction of the Christian army.

This fatal engagement took place on the 22d of March 1559; and as the succession had been already settled, Menas ascended the throne without any opposition. On his accession he found his affairs in great confusion, and he had still to contend with foreign and domestic enemies. The first of these was Radaet the king of the Jews, who had a territory in the empire of Abyssinia, the capital of which was on a rock named *Samen*. The cause of this quarrel is not known, but the event was unfortunate; the king being obliged to abandon the enterprise, after having bestowed a considerable time upon it. This was followed by an attempt to assassinate him, which had very near taken place; and this again by a conspiracy among his principal nobles headed by Isaac the Baharnagash. He had been a very faithful servant of the late emperor Claudius; but ill used by Menas, who was of a very haughty and morose disposition. In attempting to suppress this rebellion, the first attempts of the emperor were likewise ineffectual, his forces being attacked by surprise and entirely defeated. Soon after this, Isaac proclaimed Tascar, the nephew of Menas, who was then at liberty, king of Abyssinia; hoping thereby to strengthen his cause, and enable him to cope with the emperor, who was assembling a powerful army against him. This expedient did not answer the purpose. His army was entirely defeated by Menas; Tascar taken prisoner, and thrown headlong from the top of a precipice; and Isaac himself escaped with great difficulty to the confines of his own government in the neighbourhood of Masuah. Here he entered into an alliance with the Turkish bashaw of Masuah; whose friendship he gained by putting him in possession of the town of Dobarwa, with the flat country adjacent, which abounds with the provisions wanted at Masuah, and is looked upon as the key to the province of Tigré and the high lands of Abyssinia. Besides this, Isaac strengthened himself also by an alliance with the Portuguese; which, had their number been at all considerable, must have been very formidable. Their inclination to desert their former protector and ally the emperor, proceeded entirely from the shameful behaviour of their priests, who never would be satisfied without enslaving the emperor as well as his subjects to the tyranny of Rome. We have already seen that Bermudes had proceeded so far on this subject, that he narrowly escaped with his life. His successor Oviedo (for the patriarch Nugnez died by the way) fared still worse. On his introduction to the emperor Claudius, he informed him, that the pope and king of Portugal now expected no less than an immediate fulfilment of his engagements of submission to the see of Rome. This requisition was made with such an air of insolence, that the prince could scarce conceal his resentment; but restraining his passion, he promised to consider of it, and to call meetings of the learned in these matters to debate the point. This was a very fruitless task; and therefore Oviedo thought proper to quit the court towards the end of December 1558; leaving behind him an insolent letter addressed to the Portuguese.

Reign of Menas.

Rebellion of Isaac the Baharnagash.

He is defeated.

Allies with the Turks, and Portuguese.

Reason of their quarrel with the emperor.

Abyssinia. Portuguese and such converts as they had made; in which he exhorted them not to converse with schismatics, and the Abyssinians to forsake their errors. Being now debarred from access to the emperor, he began to entertain the people with seditious discourses; which practice he continued during the remaining part of the reign of Claudius and the beginning of that of Menas. The latter, perceiving the pernicious tendency of his discourses, positively commanded him to desist; which the patriarch refusing, the emperor fell upon him with his own hands, beat him severely, tore his clothes and beard, and took his chalice from him that he might thus be disabled from saying mass: after which he banished him, with Francis Lopez another of his associates, to a barren mountain, where they remained seven months in great misery. Not content with this, he issued many severe edicts against the Portuguese; prohibited them from intermarrying with the Abyssinians; and such of the Abyssinian women as were already married to Portuguese husbands, he commanded not to accompany them to their churches. His next step was to call Oviedo again into his presence, and command him, under pain of death, instantly to leave his dominions. The insolent and foolish priest refused obedience to this express command: he declared that he would obey God rather than man; and presenting his bare neck to the emperor, desired him to strike and put an end to his life at once. Menas drew his sword, but was prevented by the queen and officers who stood near him from giving the fatal stroke.

Oviedo banished to a mountain. A second beating and banishment to the mountain succeeded; and in the latter part of the sentence all the Portuguese priests as well as others were included. The Portuguese, however, determined not to submit to such an indignity; and therefore, to a man, joined Isaac; who, in expectation of more auxiliaries from India, professed a great desire of embracing the Romish religion. The king was very apprehensive, and not without reason, of the arrival of more Portuguese; but it appears that Oviedo had not sufficient interest to procure the supply he promised. An engagement, therefore, took place without them, in which Menas was again victorious; though the battle was not so decisive as to put an end to the rebellion.

Isaac again defeated. The emperor died a short time after his victory, and was succeeded in 1563 by his son Sertza Denghel, then only 12 years of age. The beginning of his reign was disturbed by new rebellions; which, however, were happily suppressed. Isaac, with his allies the bashaw and the Portuguese, seems to have remained for some time unmolested; and in the year 1569, a kind of accommodation took place. It is by no means easy to say how the Portuguese were again received into favour after such flagrant treachery and rebellion. Mr Bruce only simply tells us that "Oviedo and the Portuguese did not appear at court." This indeed is not to be wondered at, as they had been so lately at open war with the emperor. Other accounts say, that after the last battle with Isaac, "their name became so odious to all the Abyssinians, especially to their monarchs, that they would never suffer any of them to be in their army from that time." Some of these accounts say also, that Menas was defeated and killed in another battle; others, that he was driven to some high mountains, where he wandered about till death put an end

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to his misery. Accounts of this kind, however, are by Mr Bruce treated as mere falsehoods, and expressly contradictory to the annals of those times. All we can say upon the subject therefore is, that after the defeat of Isaac, the Portuguese, not excepting Oviedo himself, remained in Abyssinia, where they were more favourably dealt with by the new emperor than they had been by his father; though he was no friend to their religion, as supposing it to be destructive of monarchy and all civil government. It is probable also, that the various disturbances which happened, together with his own tender age during the beginning of his reign, would prevent him from paying that attention to them which he would otherwise have done. The Galla, a very barbarous nation, and who have at last greatly reduced the power of the Ethiopian monarchs, made frequent inroads during this reign; and in the year 1576, a league was formed by Mahomet king of Adel, with Isaac and the Turkish bashaw, who had either continued their hostilities or renewed them about this time. The emperor, however, marched with such expedition, that he did not allow them time to join their forces; and attacking them separately, gained a complete victory over them all. Almost the whole Moorish army was destroyed; but while the emperor entered Adel with a design to make a full end of his enemies on the east, he received information that the Galla had invaded his dominions on the west. Traversing the whole breadth of the empire therefore with the utmost expedition, he came up with these enemies, who were afraid to encounter him. On this he turned his arms against the Falasha, obliging them to deliver up their king, whom he banished to a mountain. Then invading the country of the Galla and Falasha, he ravaged it for four years successively, protecting at the same time the kingdom of Narea from the inroads of these barbarians.

While Sertza Denghel employed himself in repressing the incursions of the Galla, one Cadward Basha, a Turkish officer of great valour and experience, who had been invested with the office of bashaw of Masuah, began to make inroads into the province of Tigré. The emperor hastened to oppose him; but in his passage committed great devastations in the country of the Falasha, in order to provoke them to descend from their mountains and come to an engagement. These Falasha profess the Jewish religion, and were then governed by a king named *Geshen*. This monarch, provoked at the ravages and destruction he beheld, descended with vast numbers of his subjects, in order to revenge it; but was killed and his army utterly defeated by the Abyssinians, on the 19th of January 1594. The victorious Sertza then hastened to encounter the bashaw; who, confident of the superiority of his own troops, not only waited for him patiently, but gave him every advantage he could desire. A very desperate battle ensued; the event of which was doubtful, till Robel, commander of part of the king's household troops, who were armed with pikes, attacked that part of the Turkish horse where he saw the bashaw, and killed the officer who carried the standard. In doing this he broke his pike; but though then destitute of any other weapon than a short crooked knife which the Abyssinians always carry in their girdles, he instantly pushed up to the bashaw, and with it wounded him mortally

Abyssinia.

Isaac and the bashaw league with the king of Adel;

but are entirely defeated.

The emperor invades and ravages the country of the Galla and Falasha.

Tigré invaded by Cadward Basha.

King of the Falasha defeated and killed.

The bashaw defeated and killed.

K.

tally

Abyssinia.

Death of the emperor.

Two successors nominated.

Jacob raised to the throne.

Za Denghel raised to the throne.

tally in the throat. This unexpected event instantly decided the victory; the Turkish horse betook themselves to flight, and the rest of the army soon followed their example. A dreadful slaughter ensued among the Moors, who were pursued to the island Masuah; and many were driven into the deserts, where they perished with thirst. After this, marching back to the western part of his territories, the emperor proceeded to Narea, destroying the Galla as he went along. His last expedition was towards Damot to chastise some rebels there. Before he set out, a priest of great sanctity and talent for divination, is said to have warned him not to undertake the war; but his advice was rejected with contempt: on which he requested him only not to eat the fish taken out of a certain river; but this advice was also neglected, and the fish being really of a poisonous nature, the king died in consequence of eating them.

On the death of Sertza Denghel a dispute ensued about the succession. In the beginning of his sickness the late king had named for his successor his son Jacob, a boy of only seven years of age; but finding death approaching, he named his nephew Za Denghel, as being come to the years of manhood, and more fit for the government of such a numerous and turbulent people. This last resolution proved highly disagreeable to the queen and some of the principal nobility, who wished for a minority, during which they might engross the power into their own hands. In conjunction with her two sons-in-law, Kesla Wahad and Ras Athanasius, therefore, the empress determined to raise Jacob to the throne, notwithstanding the final determination of the late king above mentioned. This was put in execution immediately after the death of Sertza Denghel; Jacob was raised to the throne, and Za Denghel confined in an island of the lake Dembea or Tzana. An attempt was likewise made to seize Socinios, natural son to Facillidas grandson of the unfortunate David, who had likewise a claim to the throne; for his not being born of a lawful marriage was no objection in Abyssinia. Socinios, however, no sooner saw the fate of his cousin Za Denghel, than he withdrew himself from the power of his enemies; and Za Denghel himself, after being a short time confined in the island above mentioned, found means to escape, and took refuge among the inaccessible mountains of Gojam.

Thus disappointed in their attempts on the princes, the empress, with her two sons-in-law, were obliged to pretend loyalty to Jacob, whom they governed till he was 17 years of age. The young king then, perceiving that his tutors were taking some steps to prolong their dominion over him, took the government into his own hands, and banished one Za Selasse, whom they had employed in the execution of their projects, to the kingdom of Narea. The conspirators, alarmed at this bold exertion of royal prerogative, determined instantly to depose Jacob, and raise Za Denghel, whom they had banished, to the throne. This, however, was now a matter of some difficulty, as he had concealed himself so effectually among the mountains of Gojam, that he could scarce be found out. His retreat being at last discovered, Ras Athanasius took an opportunity of insulting Jacob, even while sitting on the throne; called him an obstinate, stubborn, and foolish boy; declared him degraded from the imperial dignity, and

that Za Denghel was coming to supplant him. Jacob perceiving, by the insolence of this speech, that he was entirely in the power of his enemies, left his palace in the night, in order to fly to the mountains of Samen, where his mother's relations were, from whom he expected protection. He got to the borders of that country, but was there discovered, seized, and brought back to his rival, who was now seated on the throne. Za Denghel, however, with a clemency not very usual in Abyssinia, did not either put him to death, or mutilate him in such a manner as to render him incapable of afterwards enjoying the kingdom; but contented himself with banishing him for life to Narea.

Za Denghel was no sooner settled on the throne, than he unluckily behaved in such a manner as to alienate the affections of his people from him entirely. This was occasioned by his attachment to the church of Rome. Ever since the time that the Portuguese had joined Isaac the Baharnagash, the entrance into Abyssinia had been shut up by the Turks, so that no new missionaries could have access; and all those who came with Oviedo being dead, the Romish religion had languished for want of preachers to support it. The last of these died in 1596; and all the rest having been dead some time before, little could be expected from the labours of a single person. Next year Melchior Sylvanus, a vicar of the church at Goa, was sent on a mission to Abyssinia; being supposed to be a proper person for this work, on account of his language and complexion which might baffle the vigilance of the Turks. He entered without being suspected; but the great defeat given the Turks by Sertza Denghel, already mentioned, had reduced their power so much, that less danger now attended this expedition than formerly, and other missionaries quickly followed.

The most learned, as well as best qualified for the undertaking in every respect, was *Peter Paetz*, who came to this country in the year 1600; and on his taking upon him the whole charge of the mission, Sylvanus returned to India. The new missionary did not at first affect to intrude himself on the emperor; but taking up his residence at the convent of Fremona in the province of Tigré, he first applied to the study of the learned language of the Abyssinians called *Geez*, and in which their books are usually written. In this he made such progress as quickly to surpass the natives themselves; after which he set up a school, where the children of the Portuguese and Abyssinians were taught promiscuously. The progress made by his scholars was so great, that he was spoken of at court, and recommended in the warmest terms to the emperor Jacob before his deposition. On this he was sent for, and appeared before the court in 1604; where, to the great dissatisfaction of the Abyssinian monks, he received such honours as are usually bestowed on men of the first quality. Next day, in a dispute before the king, two of his scholars, whom he had brought along with him, fairly vanquished the best theologians that could be found to oppose them. Mass was then said in the Romish manner; and this was followed by a sermon, which in the purity and elegance of its diction (whatever the substance might be) excelled any thing that had ever been composed in the Abyssinian language.

Though Paetz had been called to court by Jacob, yet Za Denghel was on the throne before he arrived, and it

Abyssinia.

Jacob banished.

Decline of the Romish religion in Abyssinia.

Peter Paetz restores it.

He arrives at court.

Abyssinia. it was he who witnessed the dispute and heard the sermon. He was so much charmed with the latter, that he instantly resolved to embrace the religion of the church of Rome; which resolution he soon after communicated to several of his friends, and even to Paez himself; but under an oath of secrecy. The emperor's own zeal, however, rendered this oath of no use; for in a little time he issued proclamations forbidding the observation of the Jewish Sabbath, and wrote letters to Pope Clement VIII. and Philip III. of Spain, desiring a supply of mechanics to instruct his people in the useful arts, and Jesuits to teach them religion.

His imprudent conduct occasions a rebellion. This precipitate conduct had the effect which might have been expected. The Abyssinians were generally disaffected to the church of Rome, and no pains had been taken to gain them over: they were also turbulent, savage, and rebellious: ever ready to revolt; and now had a favourable opportunity of excusing their treasons upon pretence of zeal for religion. This opportunity was quickly made use of by Za Selsasse, whom, as we have already mentioned, Jacob had banished; but who, on the advancement of Za Denghel, had probably been set at liberty. This traitor having first held many seditious meetings in private, prevailed on the Abuna, or Abyssinian patriarch, to excommunicate the king, and absolve his subjects from their allegiance. He then set out for the territory of Gojam, where the people had always been remarkable for their aversion to the church of Rome. In this place, therefore, he found no difficulty in raising an army to fight against his sovereign. Za Denghel, who was an expert warrior, did not fail to go in quest of him with what forces he could raise; but soon found, by the great desertion among his troops as he passed along, how much the excommunication pronounced by the Abuna had availed. This was so alarming, that John Gabriel, an experienced Portuguese officer, advised him to decline an engagement for the present, and take shelter in some fortress until his subjects should return to a sense of their duty. This salutary advice was rejected, from the absurd notion that it was a dishonour not to fight a rebel who had defied his sovereign. In the beginning of the engagement, victory seemed to favour the royal cause. The Portuguese carried every thing before them, and routed that wing of the enemy which opposed them. In the other wing, however, the cowardly and treacherous Abyssinians deserted their king, who was quickly surrounded by his enemies, and left in a desperate situation. A body of nobility, with his own officers and domestics, attended him, and fought desperately in his defence. Za Denghel himself, being an excellent horseman, and admirably skilled in the use of arms, performed astonishing feats of valour. At last he was thrown to the ground, grievously wounded in the breast by a lance. Notwithstanding this, he instantly recovered himself, drew his sword, and resisted his assailants so violently, that they were fain to keep at a distance and annoy him with missile weapons. In this situation he stood till almost fainting with fatigue and loss of blood; when the traitor Za Selsasse, pushing up his horse violently against him, threw him to the ground by a blow on the forehead, and a multitude then rushing upon him he was dispatched with many wounds.

The emperor excommunicated.

An army raised against him.

He is abandoned by his troops and killed.

The news of Za Denghel's death were received with such general indignation throughout the Abyssinian empire, that the rebels durst not name any successor. As it seemed natural to think, however, that Jacob would now be re-elected, messengers were dispatched to acquaint him of his good fortune; but during this interval Socinios appeared, not as a candidate, but as already in possession of the empire, and ready to support his rights by force of arms. His first step was to let Ras Athanasius know his pretensions to the throne, and desire his assistance with his army, promising to reward him as soon as it should be in his power. Without waiting for any answer, he advanced so rapidly, that Athanasius had scarce time to consider what he should reply, when a second message was sent, importing that Socinios was in the neighbourhood, and ordering preparations to be made for receiving him as his sovereign. This expeditious mode of action so much confounded Athanasius, that he complied with the requisitions, saluting him king, and joining his troops to his. Thus successful in his first attempt, Socinios made a similar one on Za Selsasse. In this, however, he was disappointed. Za Selsasse having first sent an equivocal answer, marched against him with his whole army; while Socinios, happening to fall sick, and putting little confidence in Athanasius, withdrew to the mountains of Amhara. Athanasius likewise, not knowing to whom he should attach himself, withdrew his forces, and stood neuter.

Za Selsasse had refused to join Socinios, in expectation that Jacob would make his appearance, whom he rather wished to enjoy the crown than Socinios; as under the former he might hope to engross all the power to himself. For a long time, however, no answer was returned to his messages; his troops became impatient; so that fearing lest a mutiny or general desertion should take place, he dispatched a messenger to Socinios, acknowledging him for emperor. But scarce was this done, when a messenger arrived from Jacob, informing him that he was then in Dembea, and promising Za Selsasse great honours if he would acknowledge him for his sovereign. With these terms the traitor instantly complied, and his example was followed by Athanasius; while Socinios, not as yet able to resist all his enemies, retired again to Amhara. This, however, he was not long of accomplishing. Jacob was by no means possessed of equal military skill; and though Za Selsasse was an experienced officer, yet his extreme perfidy, pride, and obstinacy, rendered it very dangerous to have any concern with him. This appeared remarkably in the present case. His pride in the first place would not allow him to join his forces to those of Jacob, lest the latter, who was inferior in military skill, should have a share in the victory he was to gain. Then, intoxicated with his opinion of himself, he neglected to behave with the caution necessary in the neighbourhood of such an experienced general as Socinios, which gave the latter an opportunity of cutting off almost his whole army. Being now obliged to fly with a few attendants to Jacob's camp, he met with an indifferent reception on account of his defeat; for which reason he made proposals to join Socinios. The latter accepted his offer, though he could put no confidence in one who had been guilty of such complicated treachery; only he thought it would be an advantage

Abyssinia. His death universally lamented.

The empire claimed by Socinios.

He is obliged to retire.

Jacob set up in opposition to him.

Bad conduct and defeat of Za Selsasse Jacob's general.

Abyssinia.
Jacob de-
feated and
killed.

advantage to put it out of his power to join his antagonist. Jacob, on the other hand, confident in his numbers, which are said to have been almost 30 to 1, advanced boldly to give his antagonist battle. Socinios declined the engagement till he had drawn him into a situation where his forces could not act with advantage. A dreadful carnage ensued, Jacob himself perished among the multitude, and his body was never afterwards found. In this battle also was killed the wicked priest Abuna Petros, who was the occasion of Za Denghel's death, as we have already related. Ras Athanasius escaped by the swiftness of his horse, and took refuge in a neighbouring monastery. He was afterwards pardoned at the intercession of Peter Paez; but his goods and estate being confiscated on various occasions, he fell into universal contempt, was abandoned by his wife, and died at last of want. According to the Abyssinian accounts, Socinios ordered the pursuit to be stopped as soon as he saw the head of Abuna Petros; but the Portuguese writers inform us, that he kept it up with the utmost vigour throughout the whole day and part of the night. They particularly mention, that a number of Portuguese, who had joined the army of Jacob, lost their lives on this occasion, by falling over a precipice which they could not avoid in the dark. One of these, named *Manual Gonsalvez*, had the good fortune to light on a tree, where he sat till morning in great terror, but at last was relieved and made his escape.

By this victory Socinios was fully established on the throne, though his situation might still be accounted precarious by reason of the rebellious disposition of many of the provinces. He began with making a general proclamation of pardon, excepting only the murderers of Za Denghel, with whom he had been in terms of intimate friendship. Being informed therefore, that one *Mahardin*, a Moor, had given him the first wound in that battle in which he was killed, he ordered his head to be instantly struck off with an axe before the gate of the palace.

Socinios fa-
vours the
Portuguese.

The Portuguese were much favoured by this prince; and they were become very numerous by continual intermarriages with the Abyssinians; the male children were always trained to the use of fire arms by their parents, and incorporated as soldiers with them; and they were now all united in one body under an experienced officer named *John Gabriel*, whom we have already had occasion to mention. As their numbers and valour made them objects of consideration, Socinios determined to attach them to himself as much as possible; and the best means to do this he knew was by favouring their priests. Peter Paez was therefore sent for to court; where a dispute concerning the supremacy of the pope and the two natures of Christ (the great subjects of debate in Abyssinia), took place, and a sermon was preached with as great success as that in Za Denghel's time. The king first enlarged the territory possessed by the Jesuits at Fremona; after which he declared to Paez his resolution of embracing the Catholic religion; giving him at the same time two letters, one to the king of Portugal, the other to the pope, the purport of which was to request a number of more Portuguese to deliver Abyssinia from the incursions of the Galla, as they had formerly done from the yoke of the Moors.

He resolves
to embrace
the Catho-
lic religion.

Before any thing of importance could be done in matters of religion, the king was called forth to suppress a rebellion which had already taken place. An impostor had appeared, who called himself *Jacob* the late king, and pretended to have escaped from the battle; but so much wounded in the face that he kept one side of it constantly covered to conceal the deformity. He made his appearance among the mountains of Habab near Masuah; and being joined by great numbers of people, Sela Christos, brother to the king, and governor of Tigré, marched against him. The impostor's troops, though numerous, fled at the first onset; but he escaped to the mountains, where it was very difficult to follow him. This, however, was attempted; and a great many of the posts he had taken were stormed like as many forts; but still the impostor himself, though driven from place to place, found means to make good his retreat to the country lying between the mountains of Habab and the territory of the Baharnagash. Thither he was pursued by Sela Christos; but that general, finding the rebellion likely to spread through the whole province of Tigré, thought proper now to acquaint his brother Socinios with the state of affairs, and to desire his assistance. The king, though at that time he had sent away most of his troops in an expedition against the Shangalla and Gongas, who dwelt on the north-west of Abyssinia, set out immediately with such troops as he could collect. These were but few in number; his cavalry, particularly, amounting to no more than 530, besides a small reinforcement brought by his brother Emana Christos, governor of Amhara. As he proceeded, he was informed that a party of Galla were lodged on a hill at no great distance from him. Determining to cut them off, he surrounded the hill where they were posted; but having caused his cavalry to advance before, and pass a deep ravine, they were almost entirely destroyed, while the rest of the army were seized with such a panic that they refused to stir. In this extreme danger, the Galla passed the ravine to attack them; but the king having advanced singly, and killed the first of them, his troops, ashamed of their cowardice, rushed forward on the enemy, and gained a complete victory, which obliged the savages to leave the province they infested at that time.

Abyssinia.
An impos-
tor pretend-
ing to be
the late
emperor
Jacob ap-
pears.

Is defeated.

The Galla
defeated.

The misfortune of the cavalry on this occasion quickly occasioned a report that the king had been defeated; of which the impostor Jacob did not fail to take advantage; and descending from his mountains, committed great devastations in the low country. But though attended by a great multitude, who likewise fought with more obstinacy than formerly, he was still defeated by Sela Christos with a force greatly inferior. But before any thing effectual could be done for his reduction, the Galla made a dreadful irruption into the southern provinces, murdering all who fell into their hands, and burning and destroying towns, churches, and villages, in the most dreadful manner. The king bore those excesses for some time with patience, till at last he drew them into such a disadvantageous situation, that being surrounded by his forces, and inferior in number as well as in valour, they were all cut off to a man, with the loss of only 400 on the part of the Abyssinians. Soon after this victory the king underwent the ceremony of coronation. He then march-
ed

An army of
Galla cut
off.
Coronation
of the king

Abyssinia. ed against the impostor Jacob; but the latter was too sensible of the superiority of his rival to face him in the field. He therefore retired again to his mountains, while the king left the suppression of the rebellion to an experienced officer named Amsala Christos; who employed two young men, who had been outlawed for murder, to assassinate the impostor. This being done, it was found that the pretended Jacob was no other than a herdsman among those mountains to which he so constantly fled for refuge; and that he had neither wound nor scar on his face, but had kept one half of it covered to conceal the little resemblance he bore to Jacob whom he personated.

The impostor Jacob assassinated.

Dangerous rebellion begun by Melchizedec.

Defeats one of the king's generals.

Causes Arzo to be proclaimed king.

Is defeated, taken prisoner, and put to death.

The rebellion continues.

The king being now freed from this rebellion, began again to turn his thoughts towards religion. His first step was to make a handsome present to the Jesuits; but he soon showed his inexperience in religious matters, by attempting to reconcile the two contending parties in his empire. Before he could see the folly of this attempt, however, his attention was called by a most dangerous rebellion, which was begun by one Melchizedec, a servant of the late Sertza Denghel, but a man of great experience in war. He was first opposed by Sanuda, a brave officer; but being totally destitute of troops, he was obliged to apply to the attendants of the king of Sennaar, who had been deposed by his subjects, and was at that time in Abyssinia. These readily joined him; and a bloody battle ensued, in which Sanuda was so totally defeated, that he alone had the good fortune to escape, and that grievously wounded, his men being all killed on the spot. On this misfortune Socinios sent his brother Emana Christos with a considerable force to reduce the rebels. Melchizedec finding himself opposed by such an able general, exerted himself to the utmost, in order to raise a force sufficient to resist him; and in this he succeeded so well, that his army soon struck terror into all the neighbouring country, notwithstanding the presence and known valour of the king's brother. A prince of the blood-royal, named *Arzo*, was likewise found out and proclaimed king, in order to give some sanction to the rebels; soon after which they boldly marched to meet the royal army. The engagement took place on the 9th of March 1611, and was fought with great obstinacy on both sides; the advantage even appeared for some time on that of the rebels; till Emana Christos, perceiving that all was at stake, pushed desperately forward to the place where Melchizedec himself was. The latter seeing no probability of avoiding a single combat, which he did not choose to try, instantly turned his horse and fled; and the rest of the army soon followed his example. Melchizedec, however, did not much avail himself of this cowardice; for he was closely pursued by the peasants, taken prisoner, and executed as a traitor, together with several of his principal officers. The fate of Prince Arzo, whom, to support their cause, the rebels had proclaimed king, is not known.

This victory, so far from extinguishing the spirit of rebellion, seemed to have inflamed it beyond all bounds: for news were now received that the whole country round the head of the Nile to the province of Tigré had revolted; so that there was a necessity for the immediate presence of the emperor himself; and even this was insufficient, as the rebels were dispersed over

such a large tract of territory. His two brothers, Emana and Sela Christos, were therefore both employed against different rebel chiefs, while the king marched against those who were most formidable. The principle on which this war was carried on seems to have been very cruel, viz. that of killing all the men, and carrying off the women and children for slaves. This was rigidly executed, first upon the inhabitants of a mountainous district named *Gusman* on the Nile; though, at the intercession of the missionary Peter Paez, the women and children, instead of being sold for slaves, were given to the Jesuits to be educated in the Catholic religion. The Gongas and Agows were next attacked with equal success, and still greater cruelty; one of their tribes named *Zalabassa*, being almost entirely exterminated: but this, instead of having any good effect, seemed to multiply the rebels still more. The Agows and Galla invaded the provinces in the neighbourhood; and another impostor, whose true name was *Amdo*, but who pretended to be the unfortunate emperor Jacob, appeared as a competitor for the crown. This last rebel proved much more formidable than any of the rest. He was indeed surprised before he had time to collect any forces; but Gideon, king of the Jews of Samen, having killed the guards who watched him, set the impostor at liberty, and supported his cause. Thus he soon collected a very formidable army, with which he defeated and killed an officer named *Abram*, who opposed him with a considerable force. This brought Socinios himself against him, who instantly attacked the Jewish monarch Gideon, as being the principal support of his cause. As the country of the Jews was naturally strong, and very full of fortified places, the reduction of it was evidently a very difficult task. The first place attacked was a fortress named *Massiraba*; which, though very strongly fortified and garrisoned, was soon taken by storm, and every one in it put to the sword without distinction. Hotchi and Amba Za Hancasse, two other strong fortresses, shared the same fate. A fourth, named *Sengannat*, no less strong than any of the former, was also taken; Gideon himself narrowly escaping with his life in the attack. Discouraged therefore by so many misfortunes, and apprehending the total ruin of his country, this prince at last was content to sue for peace; which was granted on condition that Amdo should be delivered up. This traitor was condemned to a punishment very unusual among Christians, viz. that of being crucified; but in nailing him to the cross, his cries and groans so much affected the king, that he ordered him to be taken down and beheaded.

Abyssinia.

Cruel manner of carrying on the war.

Amdo, another impostor, supported by the Jews.

War with Gideon.

Amdo delivered up and put to death.

Other military expeditions.

The war was now resumed against the Gongas and Guba; whom the king annually invaded for the purpose of making slaves. In this expedition his officers not only executed their commission against these savages, but likewise carried off a great number of cattle from the Agows, who were then at peace with the emperor. This conduct was highly resented by Socinios, who obliged them to make restitution of what they had taken away; and the doing them justice in this particular, had more effect in reducing the rest of these people to obedience, than all the cruelties which had been committed since the beginning of the war.

In 1616, the emperor set out on an expedition against the Galla: but this was laid aside on the death

Abyssinia.
The Jews
exterminat-
ed.

of his eldest son, for whom he entertained a great affection. It was succeeded by a very cruel order against the Jews, whom Socinius now determined to exterminate without any apparent occasion. His commands, however, were executed with the utmost punctuality, so that very few escaped; and among the rest perished their prince Gideon lately mentioned. He was supposed to be immensely rich, and to have concealed his riches, which have been sought for in vain by the Abyssinians from that time to the present. The children of the murdered Jews were sold for slaves; and such of the profession as were scattered through the empire, had orders to renounce their religion and be baptized, under pain of death. Thus almost the whole Jewish religion was extinguished at once, as most of them chose rather to embrace Christianity than suffer death. In token of the sincerity of their conversion, they were all ordered to plough and harrow on the Sabbath day.

Successful
expedition
against the
Galla.

After this massacre, the expedition against the Galla was resumed, and carried on with the usual cruelty: while the Galla never once appeared to prevent the desolation of their country. Next year, however, a new association was made among these savages, and the empire invaded by them in two different parts at once. One of their armies was cut off to a man before they had time to begin their ravages; while the other fled on the first approach of the royal army, leaving their wives, children, and baggage, to the mercy of the enemy. Thus the king was left for a short time at rest from rebellions or foreign invasions; and this interval he determined to make use of in making war on his neighbour the king of Sennaar, from whom he had formerly received an affront. In this expedition he was assisted by one Wed Ageeb, a prince of the Arabs, who lived on the frontiers of Abyssinia. The allies proceeded with their usual cruelty, killing all the men, and selling the women and children for slaves. Vast numbers of cattle were carried off; and the victorious armies returned with an immense booty. The next expedition was against Fatima queen of the Shepherds, otherwise called *queen of the Greeks*, who resided on the north-east of Atbara. In this also the king proved successful, though less blood was shed than usual: but it was not long before this extraordinary success met with a severe check by the entire loss of an Abyssinian army; the favourite son of the emperor himself being killed in the engagement, with some of the best officers in the empire.

War with
Sennaar,
&c.

Progress of
the Romish
religion.
Excellent
character
of Peter
Paez.

All this time Peter Paez had applied himself with the utmost assiduity to the conversion of the Abyssinians to the Catholic faith; and in this undertaking he had been attended with wonderful success. He was indeed singularly qualified for an undertaking of this kind among a rude and barbarous people: for besides an uncommon share of learning, he possessed an eminent degree of skill in the mechanical arts; by which he was enabled to teach the Abyssinians how to build houses of stone and lime, which they had never known before. In these he was at first mason, carpenter, smith, and architect himself; and thus, to the astonishment of the whole empire, he built some churches and a palace for the king. His universal genius prepared the people for the reception of his opinions; while the barbarous ignorance and savage man-

ners of his antagonists tended to prejudice every one against their tenets, though ever so just in themselves. Sela Christos, the king's brother, is said to have been converted by only reading the Abyssinian books with attention; in which, it seems, the ignorance of the priests had been displayed in an extraordinary manner. We have already seen how well the emperor himself was disposed towards the Romish church; and his example was followed by many of the principal people of the kingdom. At last the Abyssinian patriarch, named *Simon*, made a complaint that irregularities in religion had been committed, and disputes held on matters of faith, without calling him, or permission granted him, to support the clergy in these controversies. As Socinius had no high opinion of this priest's learning or eloquence, he did not imagine that any harm could ensue to the cause from granting what he wanted. A public dispute was accordingly appointed; in which Simon's inferiority was so apparent, that Socinius now publicly declared his belief in the two natures of Christ.

Abyssinia.

While the conversion was in this prosperous way, Letters arrived from the pope and king of Spain, from the pope and king of Spain. but without any promise of the temporal assistance which had been solicited; though they assured him of an ally far superior, the Holy Spirit himself, provided the emperor continued firm in his resolutions of embracing the Catholic faith. Socinius would probably have been as well satisfied with an account of a reinforcement of soldiers; but as matters stood, he was obliged to be content, and resolved to submit in form to the pope, renouncing for ever his connexion with the Greek church. As it was improper, however, to send letters on a subject of such importance by a common messenger, proper persons were to be appointed who might occasionally assume the character of ambassadors, and act accordingly. This being resolved on, the next thing was to determine the way by which the ambassadors were to reach Europe. The usual track by Masuah was now shut up on account of the rebellion which existed in the neighbouring provinces; so that the more eligible way seemed to be through Narea and the provinces to the southward, by which they might reach Melinda, and from thence embark for Goa.

Determines
to submit to
the pope.

The ambassadors were chosen by lot; which falling first on Antonio Fernandez, he named Fecur Egzie as his companion; and, all things being settled, these two set out for Gojam in the beginning of March 1613. It seems surprising that the Abyssinian monarch should have sent ambassadors on such a dangerous expedition through barbarous countries, without being accompanied by a proper guard. This, however, seems undoubtedly to have been the case; as we hear of no other attendants than ten Portuguese, whom Fecur Egzie took with him, six of whom were to go no farther than Narea, but the other four were to proceed to India: forty men armed with shields and javelins were also granted, but this force was much too small to answer any useful purpose. Sela Christos indeed furnished them with guides from the barbarous nations in the neighbourhood of Narea, taking hostages for the security of the travellers; but the insufficiency of these precautions soon appeared. Our travellers had proceeded but two days journey into the country when they

Ambassa-
dors set out
for Europe.

Account of
their jour-
ney.

Abyssinia. country of the Gongas, when they were treated in such a hostile manner, that one of the Portuguese was obliged to return with Fernandez to complain of the treatment of the savages. On this information Sela Christos instantly dispatched three officers, with a proper number of troops, to chastise them; by which means the ambassadors got safe to Mine, the name of some miserable villages on a ford of the Nile. Here they crossed the river on skins blown up, and next day entered the country of the Pagan Galla; and soon after, though not without great difficulty, they reached the kingdom of Narea, the most southerly province of the Abyssinian empire, but quite surrounded by the Galla. Here they were received with great kindness by the commanding officer of the first fortified place they came to; but on being introduced to the king himself, they met with a very different reception. This was owing to the insinuations of an Abyssinian monk, that they were to bring Portuguese soldiers that way into Abyssinia; which would be destructive to his kingdom. On calling a council, it was resolved to send them into the kingdom of Bali; so that they would be obliged to pass through a much more difficult and dangerous road than what was first intended. Having thus, as he supposed, provided against the danger which threatened his kingdom, he made them a present of 50 pieces of gold, recommending them at the same time to the ambassador from the sovereign of Gingiro, through which they were next to pass.

Description
of the river
Zebee.

On leaving Narea, they received a convoy of 80 soldiers to conduct them safely to their next stage; after which they passed four days through countries totally laid waste by the Galla, and where they were obliged to hide themselves for fear of meeting with these savages. Proceeding still through woods and vast chains of mountains, they came to the river Zebee, or more properly *Kibbee*, from its white colour resembling melted butter, as the word imports. Fernandez describes this river as larger than the Nile, and vastly more rapid. They passed it by a kind of bridge, but certainly a most tremendous one. The channel of the river is full of rocks; and betwixt every two of these a single tree was laid, so elastic that it would bend with the weight of one person; while the vast height of the precipice, and the sight of the roaring current below, was sufficient to strike the boldest with terror. At a small distance from this bridge was a ford, through which it was necessary that their mules should pass; which being accomplished without any accident, though with difficulty and danger, they entered the territory of Gingiro. Here they were hospitably received by the sovereign, and after a mutual exchange of presents proceeded to Sangara, the capital of another small kingdom named *Cambat*, which was at this time governed by a Moor named *Amelmal*. During the time of their residence here, one Manquer, a schismatic Abyssinian, arrived, who insinuated to the king that the recommendations they had brought along with them were false. This reduced them to the necessity of staying there till messengers could be sent to Socinios to know whether it was so or not; which occasioned a delay of three months. At last orders were brought to send them off immediately. This favourable answer procured the dismissal of the ambassadors with presents; while the malicious Manquer was detained prisoner. He escaped, however, and

overtook them in the next kingdom, named *Alaba*, ^{Abyssinians} which was governed by a Moor named *Aliko*. Here he accused them of a design to overturn the Mahometan religion altogether: which so exasperated the barbarian, that he threatened them all with death; and actually put them in prison, where some of the Portuguese died. At last, after holding a council, in which Manquer gave his voice for putting them to death, it was resolved that they should be sent back to Amelmal; which was accordingly done, and from his dominions they returned to Abyssinia. Thus ended this memorable embassy, by which the pope was deprived of any authentic documents which might show that any Abyssinian emperor had ever voluntarily submitted to him; and there can be no doubt that this miscarriage, more than any thing else, prevented the establishment of Popery in this country.

The ambassadors are obliged to return.

Socinios had now gone so far in favour of the Catholic party, that he began to share in some measure the fate of Za Denghel; numberless conspiracies being formed against him, which it was undoubtedly owing only to the altered situation of affairs by the preaching and assiduity of Peter Paez, that he was able to withstand. The conspirators were at this time supported, not only by the Abuna, but by Emana Christos himself, the king's brother, whom we have frequently had occasion to mention. Their first step was the very same which had been so successfully taken by Za Selasse in the time of Za Denghel, viz. to pronounce sentence of excommunication on the emperor. He was at that time absent on an expedition against the Agows; but returned immediately on hearing what was transacted in his absence; informing the Abuna, that if he did not recal the excommunication without delay, his head should pay the forfeit. This spirited declaration had such an effect, that the anathema was annulled, and the conspiracy dissolved for that time. It was next resolved between Emana Christos the king's brother, Julius his son-in-law, and Kessa Wahad master of the household, to assassinate the king in his palace. To accomplish this purpose it was concerted that they should desire an audience; that Julius should enter first, and present a petition of such a nature as would probably be refused: on this he was to begin an altercation; and during the continuance of it the other two assassins were to come up, and stab their sovereign before he had time to put himself in a posture of defence. Happily for Socinios, however, he was informed of his danger by a page just before Julius made his appearance: on which, instead of refusing the petition, he granted it immediately; so that there was no room for dispute. He then got up to walk; which was scarce done Emana Christos also came; on which Socinios invited them all to the terrace to walk with him. This prevented their falling upon him at that moment; and as they supposed they would have still a better opportunity on the terrace, they readily consented. But Socinios having opened a private door, at which he entered first, drew it quickly after him; and as this door had a spring-lock made by Peter Paez, which shut it in the inside, but could not be opened from without, the conspirators were disappointed. Being also sensible that their design had been discovered, they were obliged for some time to keep at a distance, but did not for that reason abandon their wicked projects.

It miscarries.

Abyssinia.
The rebellious spirit of the conspirators continues.

Julius the emperor's son-in-law first appears in arms.

Is deserted by his associates.

Socinius excommunicated a second time.

Rashness and death of Julius.

Emana Christos taken, but pardoned.

jects. Their next scheme was to be put in execution when the king was absent on an expedition against the people of Sennaar, who had made a violent irruption into the Abyssinian territories. The object now was not the assassination of the emperor, but of his brother Sela Christos; because the emperor had taken the government of Gojam from Emana Christos, who was a schismatic, to give it to Sela Christos, who was a violent Catholic. The enterprise was begun by Julius; who issued a proclamation, that all those who believed two natures in Christ should leave the province of Tigré, where he was governor; and that such as were true friends to the Alexandrian faith should repair to his standard to fight for it. He then ordered the goods of all the Catholics in Tigré to be confiscated; and marched without delay into Gojam, in hopes to surprise Sela Christos. But here the whole scheme was baffled by the vigilance and activity of the emperor; for he having received information of what was going forward, returned into that province before the conspirators had received certain intelligence of his having left it. This so much damped the ardour of Emana Christos and Kessa Wahad, that they stood aloof without attempting any thing till Julius should try his fortune. That rebel was at first very much disconcerted; but soon recovering his courage, advanced to the place where the Nile issues out of the lake of Dembea, where he met with the Abuna. Being confirmed by that priest in his wicked designs, he resolved, by his advice, to fall upon the king before he could be joined by Sela Christos, Simon himself (the Abuna) offering to share his fortune: and to confirm all, a new and solemn excommunication was pronounced against the king and all his adherents. Socinius, alarmed at these proceedings, sent a message to Sela Christos, desiring him to come to his assistance as fast as possible. In the mean time he himself advanced to meet Julius; but chose his posts so judiciously, that he could not be forced to an engagement without great disadvantage on the part of the enemy. Notwithstanding this, Julius pitched his camp close to that of the king, with a design to force him to a battle at all events. This rash action was followed by one still worse. Simon had persuaded him, that as soon as the royal army should see him, they would abandon the standard of the emperor to join his. On this, without farther consideration, he rushed into the camp of Socinius with a very few attendants, and reached the emperor's tent. Here he was known by the guards, and instantly dispatched with all his followers; the whole army betook themselves to flight after his death, and were pursued with great slaughter by the royalists. The plunder of the camp was immense, Julius having brought all his riches, which he had amassed by a long course of extortion, into the field along with him; and all of these were distributed among the soldiers. A vast number of cattle were likewise taken, which Socinius distributed among the priests, judges, and lay-officers. By this complete victory the whole scheme of the conspirators was overthrown. Emana Christos having no forces capable of coping with his brother, and unwilling, as we have said, to assist Julius openly, had retired to a high mountain named *Melca Amba*, in the territory of Gojam. Here he was invested by Af Christos, an experienced general, whom Sela Christos had left gover-

nor when he joined the emperor. Emana, who was likewise an expert commander, would have made a vigorous defence; but unfortunately the mountain was so destitute of water, that in three days he was delivered up by his own men, to save themselves from perishing with thirst. On being brought to the king, he was tried in a full assembly of judges, and condemned to death; but the king pardoned and sent him to Amhara.

This terrible conspiracy had been occasioned by the dispute concerning the two natures of our Saviour: another quickly followed on account of the dispute concerning the Sabbath-day; the Abyssinian church insisting on the observance of the seventh day of the week as a Sabbath, and the Romish church on the observance of the first day. The author of this rebellion was one Jonael, who had been concerned in the expedition formerly mentioned, in which the Agows cattle were driven away, and afterwards restored by the king. It is more than probable that his resentment on this account contributed much to increase his zeal on the present occasion; but whatever was the real cause, religion was the sole pretence. He began with a most insolent but anonymous letter to the king; in which the arguments of the Alexandrians for the observance of the Jewish Sabbath were stated, and the contrary doctrine condemned with the utmost virulence of expression. The king himself was reviled in the most opprobrious manner, compared to another Dioclesian, the Jesuits said to be relations of Pontius Pilate, and all of them devoted to hell without redemption. By this stupid performance the king was so much offended, that he added a clause to the former proclamation, commanding that "all out-door work, such as plowing and sowing, should be publicly followed by the husbandmen on the Saturday, under penalty of paying a web of cotton cloth for the first omission, the value of the cloth to be 5s.; the second offence to be punished by a confiscation of moveables, and the offence not to be pardoned for seven years." To this Socinius added a speech from the throne in vindication of himself, concerning the part he had taken in religious matters; and to show that he was in earnest, caused the tongue of a monk to be cut out for denying the two natures of Christ, and one of his generals to be whipt for observing the Jewish Sabbath.

In the mean time Jonael having collected what forces he could, openly declared against his sovereign; but not daring to meet him in the field, he retired into the country of the Galla, on hearing that Socinius was approaching him with an army. On this the king entered their territories, and laid them waste; which created a dissension among the savages themselves; one party being for affording him protection, the other for delivering him up. This being made known to the king, he sent a few presents to the faithless barbarians of Jonael's party; who returned his kindness by sending him the head of the rebel, though but a short time before they had fought with their brethren for his rescue.

A more formidable enemy than Jonael, however, still remained. The province of Damot was one of the most disaffected to Socinius in the whole empire; and to this place the greatest part of the religious fanatics

Abyssinia.

Another rebellion by Jonael.

He is murdered by the Galla.

Another rebellion.

Abyssinia. natics in other provinces had retired. They now mustered up an army of more than 12,000 men, among whom were 400 monks, all of them armed with shields, lances, and swords; inspired, besides, with such a degree of religious enthusiasm, that they expected to be rendered invulnerable by all terrestrial weapons, and that armies of angels would fight in their cause. Against these Sela Christos was dispatched with about 7000 excellent soldiers; and as the general himself was a zealous Roman Catholic, as well as most of his men, we need not doubt that both parties imagined themselves sure of the protection of heaven, and consequently that the encounter would be very violent. The two armies met on the 16th of October 1620; but Sela Christos was unwilling to destroy the infatuated people, who he knew would be unable to resist his veteran troops. He therefore first showed them his superiority in some skirmishes; and then sent a pathetic message, offering a general pardon if they would lay down their arms. The messengers, however, were not allowed to approach, so that an engagement became unavoidable. The numbers of the rebels, as Sela Christos had foreseen, availed very little against the discipline of the veterans he commanded. The 400 monks made a most obstinate resistance; and did not yield till after 180 of them had been killed on the spot.

Desperate enthusiasm of the monks. Socinius, having once more vanquished his enemies, now determined to show his attachment to the church of Rome more openly. Having therefore sent for Peter Paez, he told him his final resolution to embrace the Catholic religion in its full extent; after which he renounced the Alexandrian church in the most explicit manner. His renunciation was followed by a proclamation vindicating his conduct; in which, besides the arguments used for the pope's supremacy, &c. he insisted much on the bad lives of the clergy of the opposite party, and for which it appeared that there was in reality too much foundation. This was the last work of the excellent missionary Peter Paez, who died of a fever immediately after his leaving the king. The example of the sovereign, however, had very little effect upon his subjects. The proclamation was followed by a new rebellion in Amhara. Unluckily the enemies of his brother Sela Christos had persuaded Socinius to deprive him of his government: and there was no other in the kingdom who could be intrusted with such an important commission; so that the king soon found himself under a necessity of replacing and committing to him the charge of the war against the rebels. In this he was attended with his usual success: for the rebel chief, finding himself unable to contend with his enemy, repaired for assistance to the Galla; who no sooner had him in their power, than they killed him on the first offer of the imperial general, mangling his body in such a manner that scarce a bit of it remained to be sent to his antagonist.

The emperor publicly renounces the Alexandrian faith. In the mean time news of the revolution in religious matters which had taken place in Abyssinia, arrived in Europe. Though the embassy to the pope and king of Spain could not pass, as has already been related, yet frequent accounts had been otherwise transmitted; which produced such an effect, that a new set of missionaries, with a patriarch (Alphonso Mendes) at their head, were sent to Abyssinia. They arrived

at Gorgora, the seat of royal residence, in the beginning of the year 1626; and at the very first audience of the emperor, it was agreed that he should take an oath of submission to the pope. The ceremony was performed with all the splendour that could be contrived: the patriarch then preached a sermon on the pope's supremacy in the Portuguese language, intermixed with the Latin quotations; which is reported to have greatly confirmed the faith of the emperor and his brother, though neither of them understood a word of the languages in which it was preached. An answer to this unintelligible discourse was made in the Amharic language, which was equally unintelligible to the patriarch and his attendants; and to this the patriarch added a few words of a reply equally ill understood. At the conclusion of the dispute, an oath of the pope's supremacy was taken by the emperor himself on his knees, then by the princes, and afterwards by all present, according to their different stations. Sela Christos, not contented with taking the oath, drew his sword, and in words not easily understood, denounced vengeance on "those who fell from their duty:" and he likewise added to the oath of supremacy another to the emperor and Facilidas the prince royal; but if the latter should fail in the defence of the Catholic faith, he swore to be his greatest enemy: nor would he be satisfied without imposing this clause upon all the officers, whether civil or military, then present.

This violent conduct of Sela Christos procured him a number of enemies, and at last was the occasion of his destruction; but that of the king and patriarch set the whole empire in a flame. An excommunication was first pronounced upon all who did not keep the oath: a proclamation was next issued, that all priests should previously embrace the Catholic religion under pain of death; and that every one, under the same penalty, should observe Lent and Easter, according to the rules of the Romish church. The patriarch proceeded in the same style; reordaining the clergy, consecrating the churches over again, rebaptizing the people, even such as were full grown, abrogating circumcision, polygamy, and divorce (for these had been allowed by the Alexandrian church), and reducing the moveable feasts entirely to the rules of the church of Rome.

Though polygamy and divorce are no doubt inconsistent with the pure doctrines of the gospel, yet it was very improper to meddle with these practices at once in such a violent manner. Besides the confusion that this would naturally occasion in private families, these practices gave occasion to many questions in law, which it belonged to the civil judges to decide; but now these were all subjected to the authority of the patriarch: and from some other steps taken by this prelate, it appeared that he intended to encroach much farther upon the civil authority. One of these related to the church lands; which in Ethiopia are granted by the king, and resumed at his pleasure; others being granted in their place, so that neither priests nor monks have any property in them. On the present occasion, an Abyssinian nobleman had possessed some lands belonging to a Catholic monk; for which he was called before the patriarch. On his refusing to submit to this new tribunal, he was instantly condemned to restore the lands; but refusing this also, the patri-

Abyssinia. arch took an opportunity, as he was attending the emperor at church, to pronounce sentence of excommunication against him, giving him over at once, soul and body to the devil.—On hearing this terrible sentence pronounced, the nobleman fainted away, and was with difficulty recovered. On the intercession of the emperor, however, the curse was taken off; but the incident produced a very disagreeable effect on the minds of the people, who from that day began to entertain a greater aversion than ever to the Roman Catholics and their priests. This aversion was greatly increased by the absurd conduct of the patriarch, in ordering the body of an Abyssinian saint to be taken up, and thrown out of the grave in an ignominious manner, because it had been buried under the altar of a church, which he imagined was thus defiled. In all other respects, the patriarch behaved in such an insolent and overbearing manner, that the effects of his oppression soon began to be universally felt, and the Catholic religion began very quickly to decline.—The first stroke given to it was the alteration of the liturgy; which was done at the desire of the emperor. Ever since the establishment of the Catholic religion, the Latin mass book, &c. had been made use of according to the practice of the church of Rome; but as it seemed very unreasonable to impose this at once upon the Ethiopians, Socinius ordered the patriarch to make such alterations in the old Abyssinian liturgies as he thought proper, that the people might thus have an opportunity of paying their devotions in a language they understood. The patriarch, not being able to assign any solid reason to the contrary, was obliged to comply; but no sooner was this done than the people made use of their old liturgies entirely, without the least regard to the innovations of the patriarch. In the midst of the confusion which daily took place from these causes, the Galla made a dreadful invasion, and cut off one of the emperor's generals with his whole army: nor were all the abilities of Sela Christos, who had so often distinguished himself, sufficient to retrieve matters; so that the savages, after having ravaged the country for some time at pleasure, returned home loaded with booty. This misfortune was followed by the revolt of Tecla Georgis the king's son-in-law; who not only made religion the pretence for taking up arms, but insulted the Catholics in the most outrageous manner; collecting their images and other religious trinkets into a heap, and then publicly setting fire to them. After this he called before him his own chaplain, named *Abba Jacob*, who was a Catholic, stripped him of his pontificals, and killed him with his own hand. A reconciliation with Socinius was now impossible; so that he had no resource but in arms. In this however, he was equally unsuccessful with the other rebels in this reign; being defeated, taken prisoner, and put to death, along with his sister Abdera, notwithstanding the intercession of a Catholic missionary for him, and that of the queen and ladies of the court for his sister.

As the reasons given by the king for refusing such powerful intercession were purely religious, the people became more and more averse to a profession so extremely oppressive and sanguinary as that of Rome seemed to be. A revolt of the Agows quickly followed; not that religion had really any share in their de-

terminations, but that they were exasperated by the slavery and oppression to which they saw themselves subjected. They now therefore set up Melcha Christos, a prince of the royal blood, as a pretender to the crown; and soon put on such a formidable appearance, that the king himself thought proper to march against them with an army of 30,000 fighting men, which with the servants and other attendants amounted to more than 80,000. Melcha Christos retired with his troops to the craggy mountains of the country; and being imprudently followed by the emperor, rolled down such quantities of stones from the precipices, that Socinius was obliged to retreat with great precipitation, after having lost almost one half of his army.

On this defeat the emperor found himself obliged to apply to Sela Christos, whom he had again disgraced and deprived of his government. He succeeded in giving the rebels a dreadful overthrow, which for some time entirely broke their power; but this success was quickly followed by the revolt of Læca Mariam, a violent near relation of the king. He also was defeated, and obliged to retire to a mountain so steep, that though he ascended it in safety, he was dashed in pieces with many of his followers in attempting to descend; the rest, who escaped this danger, being killed by their pursuers. Still, however, the rebel Melcha Christos was unsubdued; against whom Prince Facilidas, the heir-apparent to the throne, was sent, having under him a nobleman of most distinguished character named *Keba Christos*. The latter was defeated and killed, without its being in the power of Facilidas to do any thing towards the suppression of the rebellion. This misfortune was followed by the death of Fecur Egzie, formerly ambassador with Antonio Fernandes to the pope, but now lieutenant-general to Sela Christos. He was cut off with a small body of troops by the Galla; and from many misfortunes befalling the imperial troops, the power of Melcha Christos was augmented to such a degree, that he now began to act as a king, and appointed a deputy-governor to one of the provinces. His opinion of his own importance, however, had almost proved his ruin; for the new governor having appointed a great festival on a Saturday, in opposition to the royal edict, he was attacked by a party of the king's troops, and entirely routed with the loss of 4000 of his men. This defeat was revenged by an overthrow given to Prince Facilidas himself; the blame of which was laid upon Sela Christos. The latter, as we have often had occasion to observe, was not only a most valiant commander, but a rigid Catholic; and these two qualities might naturally have been thought to secure him in favour with the emperor. His violent conduct in regard to the Catholic religion, however, had raised him so many enemies, that accusations were perpetually brought against him; and one disgrace constantly followed another, notwithstanding all his services. The present accusation was brought by one Lesana Christos, whom Sela Christos had formerly condemned to death. For this offence he had received a pardon from Socinius; and he now revenged himself upon his former judge by accusing him to his sovereign. Sela Christos was not unmindful of his conduct; and therefore, as soon as he had him in his power, put him to death without regarding the pardon he had received. The emperor

Abyssinia. on this deprived him of the government of Gojam, which he gave to Serca Christos, who has supposed to be a dependent on Prince Facilidas, and was besides cousin to the emperor himself. The new governor, on his entering upon office, promised solemnly to support the Catholic religion; but no sooner did he arrive in Gojam than he solicited Prince Facilidas to rebel against his father, and re-establish the Alexandrian faith. This was not the only instance in which he showed his disobedience. He had received the charge of a caravan which came annually from Narea; but instead of acting properly in this respect, he employed himself in driving off the cattle of the Agows and Damots, who expected no harm, and were consequently quite unprepared. Such numbers of them were carried off on this occasion, that 100,000 are said to have been sent to the Abyssinian market. Socinios, when informed of such an atrocious robbery, ordered him to restore the cattle, and to surrender himself prisoner; but instead of complying with this order, he again solicited Facilidas to revolt against his father. For this he was sharply reprov'd; but now determined to make the world believe that the prince had entered into his schemes, he sent a public message to him in which he was desired to come and take possession of the kingdom. Facilidas imprisoned the person who brought this treasonable message, and soon after sent him to Socinios; but Serca Christos still persisted in his mad attempts. He now proposed to abolish the Romish religion throughout the kingdom; and with that view attacked a convent which Sela Christos had built in Gojam: but the fathers having been furnished with some fire-arms, made so good a defence, that he was obliged to give over the enterprise. He then took the last step to complete his folly, by openly revolting against the emperor, and setting up a prince of the royal blood in opposition to him, whom he had found living in obscurity among his mother's relations. To cut off all possibility of reconciliation with the emperor, he renewed the sacrilegious practices of Georgis, and put to death a priest for refusing to deny the two natures of Christ. Thus he procured a multitude of enthusiasts to join him; but when the affair came to a decision, and Prince Facilidas with a well-disciplined army was sent against him, it then became evident how little the fanaticism of a tumultuous rabble availed against the skill of a regular army. The rebels fought, however, with great obstinacy till most of them were killed, their commander being obliged to take refuge on a mountain; from whence, being unable to make his escape, he at last came down and surrendered at discretion. We need not doubt of his fate; but notwithstanding the execution of this rebel, another still remained. This was Melcha Christos, against whom the emperor next prepared to march. He now found, however, the bad consequences of having acted so violently in favour of the Catholic religion. His army was so disaffected, that he could scarcely put any confidence in them. For this reason he issued a proclamation, that such as chose to observe the Wednesday as a fast instead of Saturday, had liberty to do so. This and some other indulgencies being reported to the patriarch, the latter sharply reprov'd him as committing an encroachment on the priesthood; and put him in mind of the punishment of leprosy inflicted upon Uzziab for assuming the priest's office. Thus an altercation commenced; and it was evident, from the behaviour of Socinios, that his extreme favour for the Romish religion began to decline. After this he set out for the country of Lasta, where Melcha Christos was, and the entrance to which was guarded by very high and rugged mountains. Among these the rebels had strongly fortified themselves: but were driven from four posts by the king's troops, so that the latter imagined a complete victory had been gained. Assembling themselves, however, on the top of another high mountain, the rebels watched their opportunity; and descending suddenly upon them, cut off great numbers, and obliged the rest to make a precipitate retreat. Another campaign was therefore necessary; but now the army lost all patience. They were become weary of making war on their countrymen, and after slaughtering them in the field, seeing the intervals between the campaigns filled up with numerous executions of those who had escaped the sword. A deputation was therefore sent from the soldiers by Prince Facilidas, who, though he had never declared his sentiments openly, was strongly suspected of being no friend to the Catholics. The purport of the deputation was, that they did not mean to say that the Romish profession was a bad one, but that it was such as they could not understand; and consequently there could be no merit on their part in professing it. They were ready, however, to lay down their lives for the public good, provided their ancient religion was restored; but this was a point they would not give up, and without which they would neither concern themselves in the quarrel, nor even wish success to the emperor's arms. With regard to the Romish religion, they added this declaration, perhaps the strongest possible mark of aversion, that they did not wish to know any thing about it. Socinios, therefore, according to the Abyssinian accounts, promised to restore the Alexandrian faith, on condition that he returned victorious from Lasta. The army then readily agreed to follow him wherever he pleased; while the rebels, having left their fortresses in Lasta, probably from a confidence in their own strength, boldly marched towards the royal army. In the engagement, however, they did not show their usual alacrity, and were soon defeated with the loss of 8000 men. Many of their best officers were killed on the spot, and Melcha Christos himself escaped only by the swiftness of his horse.

Abyssinia.

Deprived of the government of Gojam. Revolt of the new governor.

Me is defeated, taken, and put to death.

The emperor relaxes in his severity concerning religion, which is resented by the patriarch.

nishment of leprosy inflicted upon Uzziab for assuming the priest's office. Thus an altercation commenced; and it was evident, from the behaviour of Socinios, that his extreme favour for the Romish religion began to decline. After this he set out for the country of Lasta, where Melcha Christos was, and the entrance to which was guarded by very high and rugged mountains. Among these the rebels had strongly fortified themselves: but were driven from four posts by the king's troops, so that the latter imagined a complete victory had been gained. Assembling themselves, however, on the top of another high mountain, the rebels watched their opportunity; and descending suddenly upon them, cut off great numbers, and obliged the rest to make a precipitate retreat. Another campaign was therefore necessary; but now the army lost all patience. They were become weary of making war on their countrymen, and after slaughtering them in the field, seeing the intervals between the campaigns filled up with numerous executions of those who had escaped the sword. A deputation was therefore sent from the soldiers by Prince Facilidas, who, though he had never declared his sentiments openly, was strongly suspected of being no friend to the Catholics. The purport of the deputation was, that they did not mean to say that the Romish profession was a bad one, but that it was such as they could not understand; and consequently there could be no merit on their part in professing it. They were ready, however, to lay down their lives for the public good, provided their ancient religion was restored; but this was a point they would not give up, and without which they would neither concern themselves in the quarrel, nor even wish success to the emperor's arms. With regard to the Romish religion, they added this declaration, perhaps the strongest possible mark of aversion, that they did not wish to know any thing about it. Socinios, therefore, according to the Abyssinian accounts, promised to restore the Alexandrian faith, on condition that he returned victorious from Lasta. The army then readily agreed to follow him wherever he pleased; while the rebels, having left their fortresses in Lasta, probably from a confidence in their own strength, boldly marched towards the royal army. In the engagement, however, they did not show their usual alacrity, and were soon defeated with the loss of 8000 men. Many of their best officers were killed on the spot, and Melcha Christos himself escaped only by the swiftness of his horse.

The emperor require the restoration of the Alexandrian faith.

The army require the restoration of the Alexandrian faith.

Melcha Christos defeated.

By this victory the power of the rebels was broken; but it was not attended with the same satisfaction to the people with which other victories were wont to be accompanied. On viewing the field of battle along with Facilidas next day, the prince is said to have made a pathetic speech to his father; in which he told him, that the bodies of the men he saw dead on the field of battle were neither those of Pagans nor Mahometans, but of his own Christian subjects; and that victories of this kind were like driving a sword into his own entrails. "How many men (says he) have you slaughtered? how many more have you yet to kill? We are become a proverb even to the Pagans and Moors for carrying on this war; and for apostatizing, as they say, from the faith of our ancestors." The king did not make any reply at that time; but the effects of the

Pathetic speech of Prince Facilidas to his father concerning the war. * Bruce's Travels, vol. ii. 4to. p. 243.

Abyssinia. prince's words were soon apparent. The patriarch took the first opportunity of upbraiding him with his ingratitude to the Catholics, and deserting the religion whose professors had by their prayers obtained such a signal victory. To this Socinios replied in general, that he had done every thing in his power to establish the Catholic religion; for which he had shed the blood of thousands, and had still as much more to shed: but that he should consider of the matter, and acquaint him with his final resolution. This was by no means favourable; for next day, in a message to the patriarch, he recounted the many rebellions which had been excited on account of religion; and concluded with telling him, that though the faith of Rome was not a bad one, yet the people of Abyssinia did not understand it. For this reason he was determined to grant a toleration, by allowing such as professed the Catholic faith to do so in peace, and such as rather chose that of Alexandria to do the same. The patriarch replied, that he had no objection to grant this indulgence to such as had not yet embraced the Catholic faith; but those who had done so could not be permitted to renounce it without a grievous sin. Thus a new system of persecution would have commenced: but the emperor, understanding well the purport of his discourse, replied, that if this was the case he was no longer master of his own kingdom; and immediately afterwards issued a proclamation, wherein he declared the Alexandrian faith restored, with the altars for the sacrament, liturgy, and every other thing belonging to it; at the same time, that being now old and infirm, he himself resigned the crown and empire to Facilidas.

An universal toleration granted. Opposed by the patriarch.

The emperor restores the Alexandrian faith, and resigns the kingdom.

This remarkable proclamation was made on the 14th of June 1632; after which Socinios took no farther care of public affairs; nor did he long survive this transaction. He died on the 7th of September this year, and with him fell all the hopes of the Jesuits. Facilidas, as has been rightly conjectured, was an inveterate enemy to the Catholic faith. As soon therefore as he had obtained the government, even before he took upon himself the title of the king, the Catholics were everywhere displaced from offices of trust and honour; but as soon as he found himself established on the throne, a letter was sent to the patriarch, informing him, that as the Alexandrian faith was now restored, it was become indispensably necessary for him to leave the kingdom, especially as the new Abuna was on the way, and only deferred his journey till the Romish priests should be out of the country. For this reason he commanded the patriarch, with all his brethren, to leave their convents throughout the empire, and retire to Fremona in the kingdom of Tigré, there to wait his further pleasure. The patriarch attempted to soften him by many concessions, but in vain; on the 9th of March 1633 he was ordered with the rest of the fathers, to proceed immediately for Fremona. This they were obliged to comply with; but the emperor, understanding that they were about to establish themselves, and to solicit succours from Spain to accomplish their purposes by force, he sent orders to the patriarch, instantly to deliver up all the gunpowder they had at that place, and to prepare, without delay, to set out for Masuah. Still the infatuated and obstinate priest determined not to comply with the emperor's orders. At last he thought proper to deliver up the gunpowder;

but resolved to leave his companions behind him, and to disperse them as much as possible through the empire, in case he himself should be obliged to embark at Masuah; which, however, he did not by any means intend. For this purpose he applied to the Baharnagash, named *John Akay*, then in rebellion against the emperor; who carried them all off from Fremona in the night time, under a guard of soldiers, and lodged them safely in a strong fortress named *Adicotta*. Here the patriarch imagined that he might remain in safety till he should be able to procure succours from India. In this, however, he was deceived. John conveyed them from place to place, through many unwholesome situations, till their strength as well as their patience was exhausted. At last, on receiving a present of gold, he allowed them to return to their old habitation Adicotta. Facilidas, then, being determined at all events to get rid of such troublesome guests, endeavoured to prevail upon John by bribes to deliver them into his hands. John was too delicate to comply with this request, which he supposed would be a violation of hospitality; but he consented, on receiving a proper compensation, to sell them to the Turks. Two were left in Abyssinia, in hopes of soon sharing the crown of martyrdom; and this indeed Facilidas did not delay to put them in possession of, being both ordered for execution as soon as he got them into his power. Not content with this, and being perpetually apprehensive of fresh invasions from Europe, he entered into a treaty with the Turkish bashaws to keep the ports of Masuah and Suakem shut against them; by which their entrance into Abyssinia would be effectually prevented.

During these transactions, the emperor took the most effectual methods otherwise to eradicate the Romish religion, by cutting off the principal persons who professed it, or obliging them to renounce their profession. The principal of these was his uncle *Sela Christos*, who had deserved so well of the late emperor Socinios, and of the whole empire in general. His excessive bigotry in religious matters proved the cause of his destruction, as has formerly been hinted. When it was proposed to him to renounce his faith, he absolutely refused to do so, either to avoid the greatest punishment the king could inflict, or to obtain the greatest gift he had in his power to bestow. On this he was banished to an unhealthy district among the mountains of Samen; but as even here he kept up a correspondence with the Jesuits, and wished to facilitate the introduction of more Portuguese from India, he was sentenced to be hanged on a cedar tree.

Sela Christos put to death.

The expulsion of the present race of missionaries did not entirely discourage the Europeans from attempting to introduce a fresh mission into Abyssinia. The obstinate, haughty, and rebellious spirit of the Jesuits was universally condemned, and regarded as the cause of the extreme aversion showed by the emperor and the whole empire against the doctrines they professed. It was therefore hoped, and not without some appearance of reason, that the point might still be gained, provided the mission were undertaken by others less violent and insidious in their behaviour. After the execution of those who remained in Abyssinia, six Capuchins, the reformed order of St Francis, were sent with protections from the Grand Signior to facilitate their passage into

A new mission undertaken by six Francis can Capuchins.

Abyssinia. into Abyssinia, where they hoped to revive the drooping, or rather lost, cause of the Catholic religion. The event of this undertaking was truly unfortunate. The Galla murdered two who attempted to enter Abyssinia by the way of Magadoxa. Two who arrived safely in the country were stoned to death; while the remaining two, hearing at Masnah of the fate of their companions, returned home with the melancholy account of it. This bad success did not deter three others from making the same attempt a short time afterwards; but they having imprudently informed Facildas of their intention, were murdered by the bashaw of Masnah, who had received orders from him to this purpose. So particular was the emperor with regard to the execution of this order, that he caused the bashaw to send him the skin of their faces and heads; that he might know by their faces that they were Europeans, and by their shaved heads that they were priests.

Melcha Christos till continues in rebellion. The Catholic faith was now totally suppressed, but the spirit of rebellion still prevailed; and Melcha Christos continued as much in opposition to his sovereign as when he first took up arms on pretence of religion. At first he met with extraordinary success; totally defeated the royal army, though commanded by Facildas in person; after which, pursuing his good fortune, he made himself master of the capital, entered the palace, and was formally crowned king. This, however, was the last of his good fortune. Facildas having quickly recruited his army, sent three able generals to attack his rival, who was now acting the sovereign in his palace. The rebels were attacked and surrounded before they expected an enemy, were almost entirely cut off, and Melcha Christos himself was killed in the engagement.

The victory over Melcha Christos was followed by several successful expeditions against the Agows and Galla; but in the 6th year of the reign of this emperor, the rebels of Lasta, who seemed determined not to yield while there remained a possibility of resistance, chose the son of Melcha Christos for their king, and again began their depredations on the neighbouring provinces. Facildas marched against them with his usual activity; but had the misfortune to lose the greatest part of his army by cold among the mountains of Lasta, though it was then the time of the equinox, and consequently the sun was only 12° from being vertical, the latitude of Lasta being no more than 12° , and the sun 12 hours in the day above the horizon. Before this rebellion could be suppressed, another was begun, at the head of which was Claudius the king's brother. He had not the same good fortune with the rebels of Lasta; but was quickly defeated, taken prisoner, and banished to a mountain called *Wechné*; which served from that time for the imprisonment of the princes of the blood-royal. The suppression of one rebellion, however, seemed to have no other effect than that of giving rise to another. A new expedition was to be undertaken against the Agows and Shangalla; but they had posted themselves so advantageously, that the royal army was entirely defeated without being able to make any impression on their enemies. Facildas, however, knowing that this defeat could be attended with no other bad consequence than the loss of the men, which had already happened, marched direct-

ly against the rebels of Lasta without attempting to revenge the defeat he had sustained. The rebel general, weary of a contention, in which he probably saw that he would be finally unsuccessful, chose to submit unconditionally to the emperor; who, though he at first affected to treat him with severity, soon after released him from prison, bestowing upon him large possessions in Begemder, with his daughter Theoclea in marriage.

Facildas died in the month of October 1665, and was succeeded by his son Hannes. This prince was such an enthusiast for Christianity, that in the very beginning of his reign he issued a proclamation, forbidding the Mahometans to eat any flesh but what was killed by Christians; but so far was he from any inclination to favour the Catholics, that he ordered all their books which could be found in the empire to be collected and burnt. Much of his time was spent in regulations of church matters, and in contentions and trifling disputes with the clergy; which conduct so disgusted his son Yasous, that he fled twice from the capital, but was pursued and brought back. The last time was in the year 1680, when he found his father ill of the distemper of which he died. Hannes expired on the 19th of July that year, having lived at peace during the whole of his reign, excepting some trifling expeditions against the Shangalla and rebels of Lasta.

Yasous, who succeeded to the throne with the proba-
Reign of
Yasous.
tion of the whole kingdom, was of a very different disposition from his father. Generous, active, and brave, he was less bigotted, and differed from him considerably in religious principles. Having settled church matters as he thought proper, his next step, and the most glorious action of his whole reign, was to pay a visit to those of the royal family who were confined on the mountain of Wechné. He found them in the most miserable condition; all in tatters, and many almost naked; their revenue having been ill paid by his father, who was of a sordid disposition, and the little they received having been embezzled by their keepers. Yasous was greatly moved at this spectacle, ordered a large sum of money to be divided among them for present relief, clothed them according to their rank, and settled matters so that no part of their revenue could ever afterwards be improperly applied. To the governor of the mountain he assigned a large tract of territory, to make amends for the profit he had been accustomed to derive from the revenue of the princes; and finally he left all the prisoners at the foot of the mountain, at perfect liberty either to take up their residence again on it or any where else. By these extraordinary instances of royal munificence, the emperor so effectually gained the affection of his relations, that they unanimously determined to return to their former state of confinement; and during the whole time of his reign not one of them ever appeared as a competitor for the crown.

Though Yasous is said to have possessed all the qualities which constitute a great and good monarch, the natural turbulence of his subjects, and the restless disposition of the monks, soon began to show themselves by new seditions. These were preceded by a violent irruption of the Galla, who were overthrown, as usual, with great slaughter; but soon after, being solicited by some monks who had drawn over a party of the Agows

Abyssinia.
The rebels
of Lasta
submit.

His gene-
rosity to the
banished
princes.

Irruption of
the Galla,
seditions
of the
monks, re-
bellion, &c.

Agows

Abyssinia. Agows to their side, the disturbances were renewed. A grandson of Socinios, who had fled to the Galla when Facilidas first banished the princes to Wechnè, was proclaimed king. A multitude of savages immediately flocked to his standard, so that he was soon at the head of a very formidable army, while the Agows and other malecontents were ready to join him as soon as he should repossess the Nile. The king, however, entirely disconcerted the scheme by his activity; for, advancing with the utmost celerity, he reached the banks of the Nile before the Galla on the other side were ready to join their allies on this side of it. The Agows were so confounded at his presence, that they allowed him to pass the river unmolested. The Galla were equally surprised at seeing the war transferred into their own country; and, with their usual fickleness, deserted the prince whose cause they had pretended to espouse. A few remained faithful, but were utterly defeated by the forces of Yasous; the unhappy prince himself, whose name was *Isaac*, being taken prisoner, and put to death in the presence of his rival. After this, many great exploits were performed against the rebellious Agows, Galla, and other savages: but which, as they produced no other consequence than that of establishing the emperor's character for personal valour and military skill, we shall here pass over; only remarking, that, in the opinion of his subjects, one of his campaigns was the most glorious ever recorded in the annals of Abyssinia. The most memo-

Quelled by the emperor.

Attempt to revive the religious missions from Europe.

able events in the present reign regarded religion, and a renewal of the correspondence betwixt Europe and Abyssinia; of which we have a particular account from Mr Bruce to the following purpose. About the end of the 17th century, a number of Franciscans from Italy settled at Cairo in Egypt, and were maintained at the expence of the fathers in Palestine, though pretending to be independent of their superior the guardian of Jerusalem. The latter, displeased at this method of proceeding, offered to supply the mission to Egypt entirely at the expence of Palestine, and likewise to furnish from thence missionaries capable of instructing the people in the Christian religion. This proposal meeting with a favourable reception at Rome, a new set of missionaries from Jerusalem, called by our author *Capuchins*, appeared at Cairo; from whence the Franciscans were banished, only two of them being allowed to remain in that city. The others returned to Rome; where, finding that they could not re-establish themselves by fair means, they had recourse to artifice and fiction. It was now pretended, that, on the expulsion of the Jesuits from Abyssinia, a great number of Catholic Christians had fled into the neighbouring countries of Nubia and Sennaar, where they found themselves so grievously oppressed by the Mahometans, that, without some spiritual assistance, they would be under the necessity of renouncing their religion. This story being confirmed by the two Franciscans who remained at Cairo, the cause of these supposed Christians was eagerly espoused by the religious in Italy, and a new mission set on foot at the expence of the pope for their relief, which continues to this day under the title of the *Ethiopic mission*. The missionaries had it also in charge to penetrate if possible into Abyssinia; and to keep up, as far as was in their power, the Catholic faith, until a better opportunity

should offer of making an attempt to convert the whole empire. For this purpose a convent was procured for them at Achmim in Upper Egypt; and permission was granted, notwithstanding their former banishment, to settle two of their order at Cairo independent of the fathers of Palestine.

Abyssinia.

While these transactions passed in Italy and Egypt, Louis XIV. of France was in the height of his glory. He had attempted to rival the ancient Greeks and Romans in the magnificence of his works; but his conduct with regard to religion, his persecution of the Protestants, and revocation of the edict of Nantz, had stigmatized him throughout the greatest part of Europe as a bloody and merciless tyrant. To wipe off this stain, the Jesuits, his great spiritual directors, formed a scheme of inducing the emperor of Abyssinia to send an embassy to France; after which they hoped that they might get themselves replaced in the Ethiopic mission, to the exclusion of the Franciscans. The king, whose pride was very much flattered by the proposal, readily embraced it; but the pope's consent was still necessary. His holiness was by no means pleased with this intrusion of a temporal prince into spiritual affairs: nevertheless he did not choose to enter into any contest; but that he might undo with one hand what he did with the other, he appointed six Jesuits, of whom Verseau, the ambassador of Louis to himself was one, to be missionaries to Abyssinia, but the superior of the Franciscans to be his legate *à latere* at that court; providing him with suitable presents for the emperor and principal nobility.

The Jesuits now finding themselves in danger of being supplanted by the Franciscans, applied to the pope to know which of the two orders should make the first attempt to enter Abyssinia; but received no other answer than that those who were most expert should do so. Verseau, probably displeased at this conduct of the pope, went to a convent in Syria, of which he was superior, without making any attempt to enter Ethiopia: therefore the mission remained in the hands of two persons of opposite professions, a Jesuit and a Franciscan; the name of the latter being *Paschal*, an Italian; and of the former *Brevedent*, a Frenchman. The latter was accounted a man of learning and probity, zealous in the cause of his religion, but by no means imprudent or rash in his attempts to promote it.

In the mean time an unforeseen accident procured admittance to the missionaries into Abyssinia more readily than could have been expected in the present situation of affairs. Yasous and his son had both been attacked by a scorbutic disorder which threatened to turn to a leprosy; on which one Hagi Ali, a Mahometan factor at Cairo, received orders to bring with him an European physician on his return to Abyssinia. It happened that this man had formerly been acquainted with Friar Paschal, who had administered some medicines to him. He now proposed that Paschal should accompany him to Abyssinia in the character of a physician; and that Friar Anthony, another of his own order, should go with him as his companion. But this scheme was frustrated by Maillet the French consul, who had the charge of the whole from Louis XIV. and wished that the Jesuits alone should have the conduct of the mission. For this purpose he represented

Yasous fell sick, and sends for an European physician.

Friar Paschal and another Franciscan undertake the office.

to Hagi Ali, that Friar Paschal understood nothing of medicine; but he promised to furnish him with another, whose skill he extolled above all those of ancient or modern times. Hagi Ali, who knew nothing of the matter, readily agreed to Maillet's proposal; and Charles Poncet, a Frenchman, who had been bred a chemist and apothecary, was appointed to the office of physician, with Father Brevedent to attend him as his servant. Thus the scheme of the Franciscans was for the present overthrown: but unluckily Maillet employed one Ibrahim Hanna, a Syrian, to write letters to the Abyssinian monarch and some of his principal nobility, which he desired him to submit to the inspection of one Francis, a Capuchin or monk of the Holy Land, and consequently an enemy to the Franciscans. Ibrahim, not being acquainted with the monk he mentioned, and thinking any other would answer as well, carried the letters to one of the same name, but of the Franciscan order. Thus the whole secret was divulged at once; and the Franciscans, with the malevolence essential to such religious miscreants, resolved on the destruction of Poncet and his attendants. At present, however, their sanguinary intentions were defeated; Poncet set out immediately after he had received his commission, and arrived safe at Gondar the capital of Abyssinia, with his attendant Father Brevedent, on the 21st of July 1699. Brevedent died on the 9th of August; but Poncet lived to execute his commission, by making a full cure of his royal patient. On the 2d of May 1700, he set out on his return for Europe, and arrived at Masuah without any bad accident.

It has been already observed that the main end of this undertaking was to procure an embassy from Abyssinia to the French monarch; and this end also was gained. An ambassador was procured, but unluckily not such a one as M. Maillet, the chief manager of the whole project desired. This man, intoxicated with absurd notions of nobility and distinctions of rank, could not make allowance for the difference between the appearance of an ambassador from a barbarous monarch, however powerful, and one from the sovereign of a civilized and polite nation. The ambassador sent by Yasous, therefore, having been originally no other than a cook, could not be agreeable to a man of such a disposition. The presents sent by the Abyssinian monarch, indeed, had they arrived, would have probably conciliated matters. These were, an elephant, some Abyssinian young women, &c. but unluckily the elephant died, and the ambassador was robbed of all the rest by a Turkish bashaw. Maillet, therefore naturally proud, imperious, and covetous, thought proper to call in question the authenticity of Morat the ambassador's mission, to call Poncet himself a liar, and not to allow the former to proceed to France. The transactions on this occasion are set forth at length by Mr Bruce greatly to the disgrace of Maillet; but as details of this kind would swell the present article beyond due bounds, we must refer the curious reader to the work just mentioned.

Thus the scheme of procuring an embassy from Abyssinia having proved abortive, the next project of the Jesuits was to get an embassy sent from France, whose object was to be the cementing a perpetual peace between the two nations, and to establish a lasting and

commercial intercourse; though, whatever friendship or good-will might take place, it was evident that there was not a single article that could be exchanged between them, nor was there any ready communication between the two countries either by sea or land. The person pitched upon as ambassador was M. de Roule, vice-consul at Damietta. He is characterised by Mr Bruce as "a young man of some merit, who had a considerable degree of ambition, and a moderate skill in the common languages spoken in the east: but absolutely ignorant of that of the country to which he was going, and, what was worse, of the customs and prejudices of the nations through which he was to pass. Like most of his countrymen he had a violent predilection for the dress, carriage, and manners of France, and a hearty contempt for those of all other nations: this he had not address enough to disguise; and this endangered his life." Besides these disadvantages, he had the misfortune to be under the displeasure of all those of his own nation who resided at Cairo; so that the merchants were very much averse to his embassy; and, as the Franciscans and Capuchins were his mortal enemies, he had not a single friend in the world except Maillet and the Jesuits. Unluckily the consul misled him in one of the most material articles, and which was undoubtedly of the utmost consequence to him in the accomplishment of his purpose, viz. the presents necessary to be taken with him for the barbarous people through whose country he was to pass. Brocades, satins, and trinkets of various kinds, according to Mr Bruce, were the proper wares; but, instead of this, he had taken along with him mirrors of various kinds, with the pictures of the king and queen of France, wearing crowns upon their heads. The former of these subjected him to the imputation of being a magician; while the latter, if shewn to a Mahometan, would bring upon him the charge of idolatry. The worst misfortune of all was the malice and treachery of the Franciscans, who had already prejudiced against him the people of the caravan with whom he was to go, the governors of the provinces through which his road lay, and the brutal and barbarous inhabitants of Sennaar who lie in the way betwixt Egypt and Abyssinia. The consequence of all this was, that he was murdered at the last-mentioned place with all his retinue. The Franciscan friars, who had preceded him to Sennaar, left it before his arrival, and returned immediately after. There cannot therefore be the least doubt that they were the authors of his murder; though the bigotted disposition of Louis XIV. prevented all inquiry into the matter; so that the particular steps they took to accomplish their designs were never published to the world.

The assassination of De Roule was preceded by that of Yasous emperor of Abyssinia, who fell by a conspiracy of his wife and son, occasioned by a fit of jealousy in the former. He was succeeded by his son Tecla Haimanout who had conspired against him. Before his death, he had dispatched a message to the king of Sennaar, requiring him to afford M. de Roule protection at his court, and a safe conduct from it; but when the messenger was within three days journey of the capital of that kingdom, he received news of the assassination of Yasous. On this he returned

Abyssinia. turned in great haste to Gondar, in order to have the letters of protection renewed by Tecla Haimanout the reigning prince. This was readily done: but before the messenger could reach Sennaar, he was informed that De Roule was already assassinated; on which he returned with still greater haste than before. The Abyssinian monarch, provoked at such a scandalous violation of the law of nations, declared his intention of commencing hostilities against the king of Sennaar; and for this purpose assembled his army. But this was scarcely done, before he was informed that a rival, named Amda Sion, had been set up against him by the friends of his father Yasous, and had been for some time privately collecting troops to surprise him before he could be ready to make any opposition. It was therefore necessary to employ the army destined against Sennaar to reduce this rebel to obedience; and scarcely was this done, when the emperor himself was assassinated; so that all thoughts of revenging the death of M. de Roule were laid aside.

The new emperor intends to revenge his death.

but is himself murdered.

Reign of Theophilus.

Execution of the queen and other regicides.

Tigi revolts, but is defeated, taken, and put to death.

Line of Solomon set aside.

Tecla Haimanout perished in 1706, and was succeeded by his uncle Tifilis, or Theophilus; whose first care was to apprehend all those suspected to have been concerned in the death of his predecessor. Thus the murderers of Yasous, whom Tecla Haimanout had instigated, imagined themselves secure, and came to court without any fear of danger: but no sooner did Theophilus get them into his power, than he caused them all to be put to death without exception; the queen herself being publicly hanged on a tree. Not satisfied with avenging the death of Yasous by the execution of his murderers, he did the same with those of Tecla Haimanout; putting to death all who were immediately in his own power, and commanding the governors of the provinces to do the same with those whom they could find within their jurisdiction. One of these, named Tigi, who had formerly been Betwudet, having escaped into the country of the Galla, raised a very considerable army, with which he invaded Abyssinia, where he committed the most dreadful cruelties. Theophilus engaged him on the 28th of March 1709; when, with a force greatly inferior, he gained a complete victory. A number of the Galla fled to a church, hoping to be protected by the sanctity of the place; but the emperor telling his soldiers that it was defiled by those who were in it, commanded it to be set on fire, so that every one perished. Tigi, with his two sons, were taken prisoners, and put to death. The king himself did not long survive his victory; falling sick of a fever, of which he died in September 1709.

After the death of Theophilus, the line of Solomon by the queen of Sheba was superseded a second time, and a stranger of the name of *Oustas* seated on the Abyssinian throne. The extreme severity of Theophilus in punishing the murderers of both Yasous and Tecla Haimanout gave occasion to this; for as both princes had been assassinated in consequence of conspiracies formed by the principal people of the nation, the number of conspirators was so great, that the parties concerned had interest sufficient to influence the election of the new monarch, even in this most capital respect, of his not being a descendant of Solomon. Excepting this single defect, he was in every respect worthy of

the kingdom, and was already the highest subject in it. Scarcely was he seated on the throne, however, when a dangerous conspiracy was formed against him by the very persons by whom he had been placed upon it. Oustas baffled their designs, by seizing the principal conspirators before they had time to bring their schemes to a bearing: and several people of the first rank were condemned to lose their noses, or to be put to death. After this the emperor undertook an expedition against the Shangalla, according to the barbarous custom of the Abyssinian monarchs, who hunt these poor people merely for the sake of making slaves; slaughtering the men without mercy, as well as many of the women, and carrying off only the boys and girls into captivity. In this he met with perfect success; and was about to attempt the conquest of the whole country, when he was called back by the news that his prime minister Tafa Christos was dead. While the emperor remained in his capital at Gondar, he was taken suddenly ill; which he imputed at first to witchcraft, and therefore used some antidotes; among which the smoking of the palace with gunpowder was one. But this was done so carelessly by the servants, that the whole building was consumed; an accident looked upon by the people in general as a very bad omen, especially as the king's complaint increased every day. At last the principal officers came to pay him a visit of condolence, as they pretended; but in reality to observe the nature of his distemper, and to consult whether or not it was likely to continue till they could fall upon means to deprive him of the government. Oustas understood their intentions, and therefore summoned all his strength to assume for a moment the appearance of health; so that the officers found him as usual engaged in business. Being thus disconcerted, it became necessary to make some apology for a visit so extraordinary and formal; for which they were at first somewhat at a loss; on recollection, however, they told him, that hearing he had been sick, which they happily found was not the case, they had come to make a proposal concerning the succession; professing a desire that he would quiet the minds of his own family, and of the people in general, by appointing his son Fasil successor to the throne after his decease. Oustas gave them an equivocal answer; but the discourse concerning Fasil happening to be overheard by the soldiers, a violent mutiny ensued, and all the officers who had come to visit Oustas were killed. Part of the town was set on fire in the confusion; and at last a proclamation was made, that David son of Yasous was king of Abyssinia. The prince was then sent for from the mountain, and arriving at Gondar, was crowned on the 30th of January 1714. The distemper of Oustas, in the mean time continuing to increase, he died on the 10th of February the same year.

The new emperor was a rigid Alexandrian in principle; but Oustas had been so far favourable to the Catholics as to entertain some of their priests, though in a private manner. As it was the custom, however, to call a convocation of the clergy on the accession of every new emperor, the monks and others insisted upon one being called on the present occasion; the more especially that a new Abuna was come from Egypt, and the lenity shewn to the Catholics by Oustas had excited the jealousy of the Abyssinian clergy in the highest

Abyssinia.

The emperor falls sick.

Oustas deposed, and David proclaimed emperor.

Death of Oustas.

Reign of David.

Three Ro-
mish priests
put to
death.

Dissensions
among the
Abyssinian
clergy.

Great massacre of the clergy and others.

The king
poisoned.

Abyssinia.

Reign of Bacuffa.

Is lampooned by his
subjects,
and undertakes an
expedition
against
Sennaar.

A division
of his army
cut off.

Abyssinia. for the speaking crucifix; and for the rest, we are to suppose a proportional price had been paid. On the arrival of this trumpery at Gondar, the greatest rejoicings were made, and Yasous was astonished at the people having so soon forgot the loss of their countrymen and relations.

The messengers sent for the new abuna insulted and robbed.

Soon after these transactions the abuna died; but though it was customary for the Abyssinian monarchs to advance the money necessary to bring a new one from Alexandria, Yasous found himself obliged to lay a tax upon the churches for defraying it at this time, having spent all his ready money in repairing and ornamenting his palaces. Three priests, consigned to the care of as many Mahometan factors, were sent to Egypt for the new patriarch; but they were detained for some time by the naybe or prince of Masuah, who extorted from them one half of the money given by the emperor for bringing the abuna from Cairo. Yasous so soon heard that they were detained at Masuah, than he sent orders to Suhul Michael governor of Tigré to refuse provisions to the inhabitants of Masuah, which would soon reduce the naybe to obedience: but as Michael intended soon to quarrel with the king himself, he was not in any haste to obey the orders he received. The travellers were therefore detained so long, that on their arrival at Jidda, they found they had lost the monsoon; and, what was worse, the scherriff of Mececa would not allow them to pass without a fresh extortion. Their money was now exhausted; but the rapacious scherriff put one of their number in prison; where he continued for a twelvemonth till the money arrived: and from this time these extortions were changed into a stated tribute; 75 ounces of gold (about 186l. sterling) being granted for leave of passage to Cairo for the abuna; 90 ounces to the scherriff, and as many to the naybe, for allowing the abuna to pass from Cairo: an agreement which subsists to this day. Several other insults of this kind being received from the naybe, Yasous at last discovered that there was a strict alliance betwixt him, the governor of Tigré, and the Baharnagash; any one of whom, had he thought proper, could have crushed this pitiful prince with the smallest effort. On this the emperor determined to march against him in person; but was prevented by a rebellion which had been purposely excited in the country of Azab and that of the Dobas. The rebels were easily overthrown: but thus the expedition against the naybe was delayed for a year; during which interval the emperor sent for Michael to Gondar. This order was positively refused, and a war ensued. Michael, unable to contend with the emperor in the open field took to an high mountain, the usual refuge of Abyssinian rebels. Here also his bad fortune pursued him; all his posts were taken by storm excepting one, which, it was evident, would likewise have been carried, though not without a very great expence of men. Here Michael requested a capitulation; and to ensure favourable terms, he desired to put into the hands of Yasous a great quantity of treasure, which would otherwise be dissipated among the common soldiers. This being done, Michael descended with a stone upon his head, as confessing himself guilty of a capital crime, with a design to make submission to the emperor. This was prevented for one day by a violent storm of wind and rain; from which mement the Abyssinians believe he

A stated tribute for the passage of the abuna.

The emperor determines to punish the naybe of Masuah, but is prevented. War with Michael governor of Tigre.

Michael obliged to capitulate.

began converse with the devil: but Mr Bruce informs us, that he has often heard him say it was Michael the archangel who was his correspondent.

Yasous was firmly determined to put this rebel to death, notwithstanding the quantity of gold he had received; nevertheless a promise was extorted from him that he would spare his life. As soon as Michael came into his presence, the emperor was filled with indignation, retracted his promise, and ordered him to be carried out and put to death before his tent door. The execution of the sentence, however, was prevented by the intercession of all the officers of any consideration in the court or army. Such universal solicitation could not be withstood: Michael was pardoned; but with these remarkable words, that the emperor washed his hands of all the innocent blood which Michael should shed before he brought about the destruction of his country, which he knew he had been long meditating.

Yasous is obliged to pardon him contrary to his own inclination.

Michael continued for some time in prison; but was afterwards set at liberty, and even restored to his government at Tigré. No sooner was he reinstated in this dignity, than collecting an army, he attacked Kasmati Woldo, governor of Amhara, defeated him in two battles, and forced him to take refuge among the Galla, whom he soon after bribed to murder him. In other respects he behaved as a most dutiful subject, gave the king the best intelligence, and supplied him with soldiers better accoutred than he had ever before beheld. He was also more humble than before his misfortune; nor did an increase of his favour and influence make him deviate from the line he had prescribed. Having begun to gain friends by bribery, he continued to add one bribe to another to secure the old, and to gain new ones by the same means, pretending all the while to no kind of dignity or honour, not even to such as was justly due to his own rank. Thus he became such a favourite with the emperor, that he bestowed upon him the governments of Enderta and Siré, in addition to that of Tigré; so that he was now master of almost one half of Abyssinia. During the reign of Yasous, however, he attempted nothing. The foundations of the disturbances which succeeded were laid by the queen-mother, towards the end of the reign of Yasous. This emperor had been married when very young to a lady of Amhara, by whom he had two sons named Adigo and Aylo; but as his wife pretended to interfere in matters of state, he was persuaded by his mother to banish both her and her children to Weehné. After this his mother chose a wife for him from among the Galla; a people of all others the most obnoxious to the Abyssinians, both on account of the horrid barbarity of their manners, and the continual wars which from time immemorial had taken place between the two nations. The new queen was the daughter of one Amitzo, a prince who had once hospitably entertained Bacuffa before he became emperor; and his people were esteemed the least barbarous of the whole. A prejudice against her, however, against her offspring, and the emperor himself, never to be effaced, now took place among the Abyssinians; but this did not show itself during the reign of Yasous. The emperor died on the 21st of June 1753, being the 24th year of his reign, not without suspicion of being poisoned by his mother's relations, who were now attempting

He is set at liberty and raised to the highest honours.

Cause of the great civil war in Abyssinia.

Death of Yasous.

Abyssinia. tempting to engross the whole power of the empire into their hands.

Reign of Ioas. On the death of Yasous, his son Ioas by the Galla princess just mentioned succeeded to the throne without any opposition. The discontent which had taken place in the former reign about the power assumed by the relations of the old queen, now began to show itself more openly; and it was complained that a relationship to her was the only way to preferment, by which means the old families, whose merit had often saved the state, were totally excluded from every share of favour.

The Galla introduced into Abyssinia. On the accession of the young king, a party of Galla horse, said to be about 1200 in number, were sent as the portion of his mother; and these were quickly followed by a number of private persons from motives of curiosity, or hopes of preferment, who were embodied to the number of 600 into a troop of infantry, the command of which was given to Woosheka. The great favour in which these people were at court soon induced many others to make their appearance. Two of the king's uncles were sent for by his express desire; and they brought along with them a troop of 1000 horse. By the time they arrived the queen was dead; but her two brothers, named *Brulhe* and *Lubo*, finding that the king put an entire confidence in them, determined to make a party at court. This was easily effected; every thing was governed by Gallas; even the king himself affected to speak their language; while the Abyssinians were to the last degree mortified at seeing their inveterate enemies thus establishing a dominion over them in the heart of their own country. At last the king thought proper to appoint his uncle *Lubo* to the government of Amhara; but this produced such excessive discontent, that he was fain to retract his nomination lest a civil war should have ensued. While the empire was thus divided into two parties, *Suhul Michael* came to Gondar in a very splendid manner, on an application from the exiled prince of Sennaar to be restored to his kingdom. This prince, when conducted into the presence of the emperor, prostrated himself before him, owned himself his vassal, and was put in possession of the government of Ras el Feel upon the frontiers, with a large revenue, where he was advised to stay till the disputes which subsisted at that time should subside. This salutary advice, however, he had not prudence to comply with; but suffering himself to be decoyed from his asylum in Atbara, was taken prisoner and murdered.

Two of the king's uncles arrive, and engross all the power.

Suhul Michael arrives at court.

King of Sennaar murdered.

State of the different parties. In the mean time the Abyssinian prime minister, *Welled de l'Oul*, died. He had hitherto moderated the fury of the opposite parties by his wise and prudent conduct; but no sooner was he taken out of the way, than a most dreadful scene of confusion and civil war took place, which raged with the utmost violence while *Mr Bruce* was in Abyssinia, and seemed not likely to come to any termination when he left it. The whole empire was divided into two great factions: at the head of the one was the old queen, mother of *Yasous*; and at the head of the other, *Ioas* himself the emperor, with his Galla relations. Matters were first brought to a crisis by the imprudence of the emperor himself in bestowing the government of *Begemder* upon *Brulhe* one of his Galla uncles. The government of this province had been lately resigned into the hands of the queen by an old officer named *Ayo*; and it was suppo-

sed that his son named *Mariam Barea*, universally allowed to be one of the most accomplished noblemen of the kingdom, was to succeed him in this government. This opinion was farther confirmed by the marriage of *Mariam* herself with *Ozoro Esther*, a daughter of the old queen by her second husband. Unfortunately a quarrel had happened between *Kasmati Ayo*, the old governor of *Begemder*, and *Suhul Michael*, a little before the resignation of the former, and continued undecided till *Mariam* took the office upon him. The occasion was quite trifling; nevertheless, as *Mariam* had refused to submit to the decision of the judges, whom he stigmatized as partial and unjust, insisting that the king should either decide the affair in person, or that it should be referred to the decision of the sword, he thus fell under the imputation of being a disobedient and rebellious subject. In consequence of this, *Ioas* looked upon him ever afterwards with an evil eye; and now deprived him, by proclamation, of the government of *Begemder*, giving it to his own Galla uncle *Brulhe*, of whom we have already made so much mention. This unexpected promotion threw the whole empire into a ferment. As *Begemder* was a frontier province bordering on the country of the Galla, there was not the least doubt, that, immediately on the accession of *Brulhe* to his new office, it would be overrun by that race of barbarians, remarkable for their savage manners almost beyond all the other nations in Africa. This was the more dangerous, as there was not above a day's journey betwixt the frontiers of *Begemder* and *Gondar*, the capital of the whole empire. *Mariam Barea* himself, who had a high sense of honour, was particularly hurt at the manner in which he was deprived of his dignity, and condemned with his family to be subject to a race of Pagans, whom he had often defeated in battle, and obliged to acknowledge him as their superior. All remonstrance, however, was vain. *Brulhe*, under the sanction of the imperial command, advanced with an army to take possession of his new dignity: but so exceedingly averse were the Abyssinians to follow him in this expedition, that the army disbanded itself several times after it had been collected; and it took up almost a year before he could proceed from the place where his camp was, at the lake *Tzana* or *Dembea*, to the frontiers of *Begemder*, though scarce a day's journey distant. *Mariam Barea* beheld his operations with great contempt, employing his time in the dispatch of ordinary business, and endeavouring to reconcile himself to the king, but without success. As his last effort, he sent a remonstrance to the emperor; in which, after many protestations of duty and obedience, he reminded him, that, in his investiture into the office of governor of *Begemder*, he had sworn not to allow any of the Galla to enter his province; that, should he deviate from the observance of this oath, the safety of the princes in *Wechné* would be endangered; they would constantly be liable to the invasions of the Pagans, and probably be extirpated, as had already happened at two different times; and he begged of the emperor, if he was determined to deprive him of his government, to bestow it rather upon some Abyssinian nobleman; in which case he promised to retire, and live in private with his old father. He had, however, formed a resolution, which he thought it his duty to submit to the emperor, that if his ma-

Abyssinia.

Brulhe made governor of *Begemder*. An universal ferment ensues.

Is opposed by *Mariam Barea*.

Abyssinia. jesty should think proper to come, at the head of a Galla army, to invade his province, he would retire to the farthest extremity of it, till he was stopped by the country of the Galla themselves; and so far from molesting the royal army, he might be assured, that though his own men might be straitened, every kind of provision should be left for his majesty. But if an army of Galla, commanded by one of that nation, should enter the province, he would fight them at the well of Fernay, on the frontiers, before one of them should drink there, or advance the length of a pike into the province.

Farther promotion of Michael. This remonstrance had no effect upon the emperor. He returned a scoffing answer, announcing the speedy arrival of Brulhe, whom he thought sure of victory; but, at the same time, to show that he did not put his confidence entirely in his prowess, he created Suhul Michael governor of Samen, which lay next to Tigré in the way to Begemder, so that no obstruction might lie in the way of that officer's march to Gondar, in case there should be any occasion for him. Mariam, provoked at the manner in which he was undervalued in the king's message, gave an ironical reply, in which he alluded to the name of *Brulhe*, in the Abyssinian language signifying a kind of *bottle*; this he told him would be broken on the rocks of Begemder, if sent into that country.

Brulhe defeated and killed. On receiving this last message from Mariam, the king instantly ordered the army to be put in motion; but the Abyssinians had unanimously determined not to act offensively against their countrymen. Brulhe therefore was left to decide the affair with his Galla. Mariam kept exactly to his word in the declaration he had made to the king, not stirring out of his province, nor allowing the least attempt to be made to harass his enemy, till they were drawn up at the well above mentioned, where he met them with his army. The Galla, unsupported by the Abyssinian troops, were utterly unable to bear the shock of Mariam's army, and therefore soon betook themselves to flight; but a part of them, who were surrounded by the cavalry, fought valiantly till they were all cut to pieces. Mariam had given the most express orders to take Brulhe alive; or, if that could not be done, to allow him to make his escape. One of his servants, however, observing him in the field, pushed up through the enemy to the place where he was, and running him twice through with a lance, left him dead on the spot.

Michael created Ras. Mariam Barea was no sooner informed of the death of his rival, than he cried out in great emotion, that Suhul Michael, with the whole army from Tigré, would attack him before autumn. In this he was not deceived. Ioas instantly dispatched an express for Michael, ordering his attendance, and investing him with the dignity of Ras, by which he became possessed of unlimited power both civil and military. Michael himself had for a long time seen that matters would come to this crisis at last, and had provided for it accordingly. He now set out with an army of 26,000 men, all of them the best soldiers in the empire, and 10,000 of them armed with muskets. As he passed along, his troops desolated the country wherever they came, but he encumbered his army by nothing useless; allowing his men to carry along with them neither women, tents, beasts of burden, nor even provisions.

Abyssinia. The subsistence of his troops was abundantly provided for by the miserable inhabitants of the provinces through which he passed; and not satisfied with this, he insisted on a contribution in money from all the districts within a day's march of those places where he was; the least delay was followed by the slaughter of the inhabitants and destruction of their houses. Towns, villages, and buildings of every kind, were set on fire as he passed along; the people fled from all quarters to the capital for refuge, as from the face of the most inveterate enemy; and Ioas himself was now sensible of his having been in the wrong to invest him with such unlimited power. On his arrival at the capital, Michael took possession of all the avenues, as if he meant to besiege it; so that an universal consternation ensued. Instead of offering any hostility, however, he waited with the utmost respect on the emperor, proceeding immediately from the royal presence to his own house, where he sat in judgment, as the nature of his office required him to do. No sooner had he taken upon him this new office, however, than he executed justice in such a rigorous and impartial manner as made the boldest offenders tremble. Some parties of his own soldiers, presuming upon the licence that had hitherto been granted them, entered Gondar, and began to plunder as they had done in other places; but, on the very first complaint, their commander caused 12 of them to be apprehended and hanged. Their execution was followed by 50 others in different quarters of the city; after which he gave the charge of the capital to three officers who were to preside over three quarters, himself taking care of the fourth. Two civil judges were appointed to assist each officer in a district, two were left in the king's house, and four of them held a court of judicature in his own. Thus the inhabitants finding, that instead of bloodshed and massacre, they were to expect nothing but strict equity and moderation, became reconciled to Michael the day after his arrival, and lamented only that he had not come sooner to relieve them from the anarchy and confusion in which they had been held so long. To so great a degree of perfection indeed did he bring his legislation, that a very short time after he entered the city, a loaf of bread, a bottle of water, and an ounce of gold, were exposed in the market-place on the head of a drum night and day for some time, without any one offering to take them away. This was the more remarkable, as there was then a scarcity of provisions, and Michael himself would allow but a very scanty supply of water to be carried into the city; thereby giving the inhabitants to understand, that if he should set fire to it as he had done to other places, it would not be in their power to quench the flames.

Marches against Mariam Barea. The capital being thus secured in perfect obedience, Michael next prepared to set out on his expedition against Mariam Barea. Sensible, however, that the destruction of this worthy nobleman would be attended with a great degree of odium, he was resolved that none of it, or at least as little as possible, should fall upon himself. For this purpose, he insisted that the emperor should march in person from Gondar, and carry all his soldiers along with him. Thus he had an opportunity of throwing the whole blame upon Ioas, and representing himself as no more than a passive instrument in the affair. He also took every occasion of praising

Abyssinia. praising his antagonist for his virtues, and censuring the emperor for attempting to cut off such an excellent officer.

In the mean time Mariam Barea keeping exactly to the terms of the last remonstrance he had sent to Ioas, retired before him to the extremity of the province. Ioas and Michael advanced furiously, burning and destroying every thing as they went along. An engagement at last ensued at a place called *Nefas Musa*, on the extreme borders of Begemder, when Mariam could not retreat without going out of the province.

Mariam de- As the royal army was more than twice the number of the other, and commanded by an officer of superior skill, victory was not long of being decided in its favour. Mariam with 12 of his officers, took refuge in the country of the Galla; but were immediately delivered up by that faithless people. He was put to death by Lubo the brother of Brulhe, who is said with his own hands to have cut his throat as a sheep is commonly killed in this country, and afterwards to have disfigured the body in a shocking manner. The head was cut off, and carried to Michael's tent, who would not allow it to be uncovered in his presence. It was afterwards sent to the family of Brulhe in the country of the Galla, to shew them what attention had been given to revenge his death; and this displeased the Abyssinians even more than any thing that had yet happened since the beginning of the contest.

etrayed y the Gal- The 12 officers, who were taken along with him, sought protection in the tent of Ras Michael, to which they were suffered to escape by Woosheka their keeper. Lubo, however, intended likewise to have sacrificed them as he had done Mariam, and therefore sent Woosheka to demand them: but no sooner had he unfolded his errand, than Michael, in a rage, called to his attendants to cut him pieces before the tent door; which would certainly have been done, had he not fled with the utmost precipitation.

some of his The scandalous ascendancy which the Galla always manifested over the king, had greatly displeased Michael; who expressed himself so freely on the subject, that a coolness took place between them. Another officer named *Waragna Fasil*, a Galla by birth, had insinuated himself into the king's favour, and greatly distinguished himself at the battle of Nefas Musa. It was no wonder, therefore, that he soon became a rival to Michael; and this rivalry was greatly augmented by the following circumstance. Near the field of battle at Nefas Musa was a house of Mariam Barca, where Ozoro Esther his widow now was. Being surrounded by pleasant and verdant meadows, Fasil encamped there for the sake of his cavalry. No other design was at that time apparent; however his presence greatly alarmed the princess. She had along with her at that time a nobleman named *Ayto Aylo*, who had been at the battle of Sennaar; but had there been terrified to such a degree, that he resolved to renounce the world ever after and turn monk. In this character he was now with Ozoro Esther: and though he refused to be concerned in any military affairs, he was still consulted by both parties as a kind of oracle. In the present emergency, therefore, he told the princess that there was only one way by which she could secure herself from the cruelty of the Galla, and becoming a prey to one or other of the murderers of

disagree- her husband; and that was by immediately espousing Ras Michael. Ozoro was perfectly sensible of the propriety of the advice, and therefore set out next morning in company with Aylo to Michael's tent. Here she threw herself at his feet on the ground; and refusing to rise, Aylo explained her errand, informing the Ras that she intended to bestow herself upon him in marriage, as being the only person not guilty of her former husband's death capable of affording her protection in her present situation. Michael saw clearly the advantages attending such a match; and therefore having caused the army to be drawn up in order of battle, as if for a review, he sent for a priest, and was married to the princess in the sight of all his men. The ceremony was followed by the loud acclamations of the whole army; and Ioas was soon informed of the reason. He expressed his displeasure at the match, however, in such unequivocal terms, that a mutual hatred from that moment commenced. This was soon made public by a very trifling accident. One day while the army was marching, Michael being much incommoded by the sun, which affected his eyes, threw a white handkerchief over his head to keep off the heat. This was instantly told the king, who took it as an affront offered to himself; for in Abyssinia it is unlawful to cover the head on any occasion whatever in presence of the emperor, or even within sight of the palace where he lodges. Ioas was no sooner informed of the supposed affront, than he sent to the Ras to know upon what account he presumed to cover his head in his presence; but though the covering was instantly taken off, it was thought that no atonement could ever be made for such a grievous offence. Soon after this a quarrel happening between Fasil and a person named *Gusho*, likewise a man of great consequence, complaint was made to the Ras, who, as civil judge, summoned both parties before him. Fasil absolutely refused to obey any such jurisdiction; and the affair being laid before the other judges, it was given in favour of Michael, and Fasil declared to be in rebellion. This was followed by a proclamation depriving him of his government of Damot, and every other public office he held. Fasil, however, had no mind to submit to this disgrace; and therefore, after holding a long conference with the king, departed with his army, encamping on the high road betwixt Damot and Gondar, where he intercepted the provisions coming from the southward to the capital. This was followed by an attempt to assassinate the Ras. A shot was fired from one of the windows of the palace into the house where he sat in judgment; the distance being so small, that he could easily be seen from the palace while thus employed. The ball, however, missed Michael, but killed a dwarf who was standing before him fanning the flies from his face. As it was evident that this shot must have been fired with the knowledge of the king, it was rightly judged to be the commencement of hostilities. Ioas instantly removed to a distance, but sent Woosheka with orders to the Ras to return to Tigré without seeing his face; declaring, at the same time his own uncle Lubo governor of Begemder and Amhara. Michael could scarcely be prevailed upon to see Woosheka, and told him that he should certainly be put to death the next time he appeared in his presence. Next day Ioas sent a message to the Ras by four judges, commanding him to return to Tigré without

her husband; and that was by immediately espousing Ras Michael. Ozoro was perfectly sensible of the propriety of the advice, and therefore set out next morning in company with Aylo to Michael's tent. Here she threw herself at his feet on the ground; and refusing to rise, Aylo explained her errand, informing the Ras that she intended to bestow herself upon him in marriage, as being the only person not guilty of her former husband's death capable of affording her protection in her present situation. Michael saw clearly the advantages attending such a match; and therefore having caused the army to be drawn up in order of battle, as if for a review, he sent for a priest, and was married to the princess in the sight of all his men. The ceremony was followed by the loud acclamations of the whole army; and Ioas was soon informed of the reason. He expressed his displeasure at the match, however, in such unequivocal terms, that a mutual hatred from that moment commenced. This was soon made public by a very trifling accident. One day while the army was marching, Michael being much incommoded by the sun, which affected his eyes, threw a white handkerchief over his head to keep off the heat. This was instantly told the king, who took it as an affront offered to himself; for in Abyssinia it is unlawful to cover the head on any occasion whatever in presence of the emperor, or even within sight of the palace where he lodges. Ioas was no sooner informed of the supposed affront, than he sent to the Ras to know upon what account he presumed to cover his head in his presence; but though the covering was instantly taken off, it was thought that no atonement could ever be made for such a grievous offence. Soon after this a quarrel happening between Fasil and a person named *Gusho*, likewise a man of great consequence, complaint was made to the Ras, who, as civil judge, summoned both parties before him. Fasil absolutely refused to obey any such jurisdiction; and the affair being laid before the other judges, it was given in favour of Michael, and Fasil declared to be in rebellion. This was followed by a proclamation depriving him of his government of Damot, and every other public office he held. Fasil, however, had no mind to submit to this disgrace; and therefore, after holding a long conference with the king, departed with his army, encamping on the high road betwixt Damot and Gondar, where he intercepted the provisions coming from the southward to the capital. This was followed by an attempt to assassinate the Ras. A shot was fired from one of the windows of the palace into the house where he sat in judgment; the distance being so small, that he could easily be seen from the palace while thus employed. The ball, however, missed Michael, but killed a dwarf who was standing before him fanning the flies from his face. As it was evident that this shot must have been fired with the knowledge of the king, it was rightly judged to be the commencement of hostilities. Ioas instantly removed to a distance, but sent Woosheka with orders to the Ras to return to Tigré without seeing his face; declaring, at the same time his own uncle Lubo governor of Begemder and Amhara. Michael could scarcely be prevailed upon to see Woosheka, and told him that he should certainly be put to death the next time he appeared in his presence. Next day Ioas sent a message to the Ras by four judges, commanding him to return to Tigré without

Abyssinia. Michael marries the princess Ozoro Esther.

Final quarrel betwixt Michael and Fasil.

A shot fired from the palace window.

Abyssinia. without the least delay, under pain of his highest displeasure. Michael returned a formal answer, concluding, that he expected the king himself to be ready to march against Fasil to-morrow. To this an absolute refusal was given: on which Michael issued a proclamation, commanding all the Galla to leave the capital next day under pain of death: in case of disobedience they were declared outlaws, and liable to be killed by the first that met them if they were found 24 hours after the proclamation in the capital, or to the same penalty if they were found in the kingdom after ten days. An engagement took place a short time after, in which Fasil was totally defeated, and obliged to retire into Damot. In this engagement some of the king's black horse were taken. These were all slaves, and subject to no other commands but those of his majesty himself. Their appearance clearly showed that they must have been sent by the king to fight against the Ras. All of them were therefore brought before the latter, and interrogated by whose orders they had come to the battle. Two refused to give any answer, and had their throats cut in presence of their companions. A third plainly told him that they had been sent by the king; who had likewise ordered an Armenian to fire out of the palace window at Ras Michael. On this the prisoners were dismissed; but assassins instantly dispatched to put an end to the king's life; which they accomplished, and buried him in a church dedicated to St Raphael.

Fasil defeated by Michael.

Ioas assassinated.

Hannes set up by Michael, and soon after poisoned.

Reign of Tecla Haimanout. Fasil defeated.

On the death of Ioas, Michael, now absolute master of Abyssinia, set up for emperor Hannes, brother to the late king Bacuffa, an old man who had resided almost all his lifetime on the mountain of Wechnè, and being entirely unacquainted with the affairs of the world, was on this account probably supposed by Michael to be the more proper for his purposes. Hannes had been maimed by the loss of his hand, on purpose to incapacitate him for the throne; but this objection was laughed at by the Ras. He found him, however, possessed of a quality much more inimical to his own purposes; and that was, an absolute aversion at meddling with the affairs of government: so that he could not by any means be induced to take the field against Fasil. Michael therefore was obliged to set out by himself; but thinking it improper to leave a king of any kind behind him in the capital, he had the old man poisoned before his departure; putting his son Tecla Haimanout in his place.

The young emperor, according to Mr Bruce's account, was of a fair complexion, less tawney than a Neapolitan or Portuguese, owing to his having been born in the mountain. He was endowed with many princely accomplishments; and so much attached to Michael Ras, that he called him *Father* from the time of his accession, waiting upon him when indisposed with the affection of a son. There being now no objection, therefore, Michael marched against Fasil without delay, and entirely defeated him on the 3d of December 1769. On this occasion Woosheka was taken prisoner, and afterwards fled alive, notwithstanding the intercession of some of Michael's officers for him; his skin being afterwards formed into a bottle. This piece of cruelty was attributed to Ozoro Esther; whom Mr Bruce represents as the most humane and merciful of women; though he is obliged to allow, that on the present occasion, as well as on every other which re-

garded her former husband, she entirely forgot her character. The night on which this miserable victim was destroyed, she appeared in the king's tent dressed like a bride; and in a little time returned in triumph to Gondar.

Soon after these transactions Mr Bruce entered Abyssinia. He arrived at Masuah when there was only a report of Hannes's being ill, and Mr Bruce was supposed to be his physician, though in truth that emperor was already dead. Here he was ill-treated by the naybe, with a design to extort money, and afterwards probably to put him to death, as was his custom with other strangers. He escaped the danger, however, by the protection of Achmet, nephew and heir apparent to the naybe, and by his own prudent and resolute behaviour; threatening his adversaries with the arrival of a British man of war in case of any injury; showing the Grand Signior's protection; making use of the name of Ras Michael, now so formidable, and to whom he had obtained a recommendation, &c. After many vexations and delays, he was at last allowed to depart; and a guide, by name *Saloomé*, was sent along with him. This man was brother-in-law to the naybe, and a professed Christian; but a traitor in his heart, and who wished to do every thing in his power to hurt our traveller. He was furnished with another guide, however, by his friend Achmet, to inform him where to pitch his tent, and other necessary particulars.

On the 15th of November 1769 Mr Bruce left Ar-keeko, on the eastern coast of Africa, and proceeded southwards for Gondar the capital of Abyssinia. After an hour's journey, he pitched his tent near a pit full of rain water, where he remained all day; and in the evening a messenger arrived from the naybe, who took away the guide *Saloomé*. Next day the latter returned in company with Achmet the naybe's nephew already mentioned. The latter caused him deposit in his hands *Saloomé's* full hire, as though he had gone the whole length he had promised. Four of the men were commanded to go back to Ar-keeko, and others put in their place: after which Achmet told Mr Bruce that he was not to take the road through Dobarwa, though near, because it belonged to the naybe; but that *Saloomé* knew another by a place called *Diccan*, which belonged to himself, and where he could insure him of a good reception. In this journey, he told him, that he would be obliged to cross the mountain of Taranta, the highest in Abyssinia; but the fatigue of this would be more than recompensed by the assurance of safety and the curiosity of the place. Taking leave of Achmet in a very friendly manner, therefore, Mr Bruce with his company finally set out on their journey the evening of the 16th. For the short space they had travelled, the ground was covered with grass broader in the leaf than ours; but in a little time the soil became hard, dry, gravelly, and full of acacia or Egyptian thorn. Next day (the 17th) they changed their course from south to west; and soon arrived at a range of mountains standing so close to one another, that there was no passage between them excepting what was worn by torrents of water; the bed of one of which consequently now became their road. In the evening they pitched their tent at some distance from this torrent, which had scarcely any water in it when they left it; but all the afternoon there had been an appearance of rain, with much

Abyssinia. Mr Bruce's arrival and adventures in Abyssinia.

Sets out from Ar-keeko.

Account of the country through which he passed.

Abyssinia. much thunder and lightning, at a distance. On a sudden they heard a noise among the mountains louder than thunder; and instantly saw the torrent, swelled immensely by the distant rains, now running like a rapid river, and the foremost part of it advancing in its bed in a body of water about the height of a man. Having run for some time in this violent manner, the current, no longer supplied by the rains, began to diminish, and by the next morning was quite gone. Among these mountains the nights are cold even in summer.

On the 18th the journey was resumed in the bed of the torrent, which now scarcely had any water: though the stones were rendered very slippery by the quantity of rain which had fallen. Leaving this disagreeable road, they came to a fine rivulet; which being the first clear water they had seen from the time Mr Bruce left Syria, was exceedingly agreeable. They proceeded along the banks of this river for some time; and soon after leaving it, they came to another of the same kind: but next day were obliged to resume their course in the bed of a torrent. The mountains in this part of the world are excessively rugged and full of precipices, entirely destitute of soil, and covered with loose stones of a black colour. On the side of the torrent in which they marched, however, there grew very large sycamore trees, some of them little less than 7½ feet in diameter. Their branches afforded shelter to an infinite number of birds; many of them without song; but others having notes very different from the European kinds, and peculiar to the continent of Africa. Most of those which had very beautiful colours were of the jay or magpie kind. The trees were loaded with figs; but they came to nothing, by reason of the ignorance of the savages, who knew not the process of caprification. The streams of water themselves, which at this season were found so delightful, run only after October; they appear on the other side of the mountains when the summer rains in Abyssinia are ceasing; at other times no water is to be met with, excepting what is contained in stagnant pools.

On the 20th of November they began to ascend the high mountain of Taranta. Their road was now exceedingly rugged and uneven, intersected with monstrous gullies and holes made by the torrents, as well as by huge fragments of rocks which had tumbled down. It was with the utmost difficulty that they could carry the astronomical instruments up the hill; in which work Mr Bruce himself, and one of his attendants named *Yasine*, a Moor, bore a principal share. The only misfortune they met with was, that their asses being unloaded, and committed to the care of a single person, refused to ascend this barren mountain; and in spite of all that their drivers could do, set off at a brisk trot for the fertile plains below. Luckily, however, they were afterwards recovered by four Moors sent after them, and the journey resumed without any material interruption. The beasts were now become much more tractable, having been seen and pursued by the hyænas with which that mountain abounds.

Taranta is so destitute of earth, that there was no possibility of pitching a tent upon it; so that our travellers were obliged to take up their lodging in one of the caves with which it abounds. The under part of

the mountain produces in great plenty the tree called *kolquall*, which was here observed in greater perfection than in any other place throughout the whole journey. The middle part produced olives which carried no fruit; and the upper part was covered with the oxycedras or Virginia cedar, called *arze* in the language of the country. On the top is a small village named *Malai*, inhabited by poor shepherds, who keep the flocks of the rich people of the town of *Dixan* below. They are of a dark complexion, inclining to yellow; their hair black, and curled artificially by means of a stick, and which our author supposes to be the same with the *crisping-pin* mentioned Isa iii. 22. The men have a girdle of coarse cotton cloth, swathed six times round their middle; and they carry along with them two lances, and a shield made of bulls hides. Besides these weapons, they have in their girdles a crooked knife with a blade about 16 inches in length, and three in breadth at the lower part. There is here great plenty of cattle of all kinds; the cows generally of a milk white, with dewlaps hanging down to their knees; their horns wide like those of the Lincolnshire cattle; and their hair like silk. The sheep are all black, both here and throughout the province of *Tigré*; having hair upon them instead of wool, like the rest of the sheep within the tropics; but remarkable for its lustre and softness, without any bristly quality. On the top of the mountain is a plain, which, at the time our author was there, they had sown with wheat. The air seemed excessively cold, though the barometer was not below 59° in the evening. On the west side, the cedars, which on other parts are very beautiful, degenerate into small shrubs and bushes.

The road down this mountain was for some time nothing inferior in ruggedness to what they had met with in ascending it; but as they approached *Dixan*, it became considerably better. This is the first town on the Abyssinian side of *Taranta*. It is seated on the top of a hill of a form exactly conical, surrounded by a deep valley like a ditch; and no access to it but by a path which winds round the hill. The inhabitants were formerly exterminated by *Michael Ras*; and the succeeding race, in Mr Bruce's time, were of a very indifferent character, being, as he says, composed of the worst people from the territories of the *Baharnagash* and the province of *Tigré*, on both of which it borders. Here he was in danger from the treachery of *Salome*, who wished to have decoyed him into the power of some assassins. Finding that this could not be done, he surrounded Mr Bruce and his retinue with a body of armed men; but they were dispersed by the authority of *Hagi Abdelcarder*, the friend of *Achmet*, who had received orders to provide for the safety of the travellers. The only trade carried on here is that of buying and selling slaves; who are stolen from Abyssinia, chiefly by the priests, and sent into Arabia and India.

The next stage was from *Dixan* to *Adowa*, capital of the province of *Tigré*. Leaving *Dixan* on the 25th of November, they pitched their tent the first night under a large spreading tree called *daroo*, which Mr Bruce says was one of the finest he saw in Abyssinia, being about 7½ feet in diameter. They had been joined by some Moors driving 20 loaded asses and two bulls, which in that country are likewise used as beasts of burden.

Abyssinia.
Of the vil-
lage *Halai*,
and inhabi-
tants of the
mountains.

Beautiful
cattle, &c.

Town of
Dixan de-
scribed.

Journey to
capital of
Tigré.

Abyssinia.
udden
well of a
torrent.

Notes of
the African
birds differ-
ent from
those of
Europe.

account of
the moun-
tain *Taranta*.

Abyssinia.

His treacherous guide obliged to return.

The country becomes more fertile as he passes along.

Adowa described.

Visits the ruins of Axum.

burden. Here, our author says, he recovered a tranquillity of mind which he had not enjoyed since his arrival at Masuah; but they were now entirely without the dominions of the naybc, and entered into those of the emperor. Saloomé attended them for some way, and seemed disposed to proceed; but one of the company, who belonged to the Abyssinian monarch, having made a mark in the ground with his knife, told him, that if he proceeded one step beyond that, he would bind him hand and foot, and leave him to be devoured by wild beasts.

Being now in a great measure delivered from their fears and embarrassments, the company proceeded on their journey with pleasure, through a much better country than they had hitherto passed. In some places it was covered with wild oats, wood, high bent grass, &c. but in not a few places rocky and uneven. Great flocks of a bird as large as a turkey, called in the Amharic language, *erkoom*, were seen in some places. A large animal of the goat kind, called *agassan*, was found dead and newly killed by a lion. It was about the size of a large ass, and afforded a plentiful repast. Numbers of kolquall trees were also seen; and the sides of the river Habesh were adorned with a beautiful tree of the same name with the stream. There were in this place also many flowers of various kinds, particularly jessamine. The mountains of Adowa, which they came in sight of on the 5th of December, are totally unlike any thing to be met with in Europe; their sides being all perpendicular rocks, like steeples or obelisks of many different forms.

Adowa, though the capital of an extensive province or kingdom, does not contain above 300 houses; but occupies nevertheless a large space, by reason of the inclosures of a tree called *wanzey*, which surround each of the houses. It stands on the declivity of a hill, situated on the west side of a small plain surrounded by mountains. It is watered by three rivulets which never become dry even in the greatest heats. A manufacture is carried on here of a kind of coarse cotton cloth which passes for money throughout all Abyssinia. The houses are built of rough stone cemented with mud; lime being only used in the construction of those at Gondar, and even there it is very bad.

Our traveller was very hospitably entertained at Adowa, by one Janni, with whom he resided during his stay there. Leaving it on the 17th of December, he visited the ruins of Axum, once the capital of the empire. Here are 40 obelisks, but without any hieroglyphics. A large one still remains, but the two largest are fallen. There is also a curious obelisk, of which he gives a figure, with other antiquities which our limits will not allow us to enlarge upon. The town has at present about 600 houses, and carries on manufactures of the coarse cotton cloth already mentioned. It is watered by a small stream which flows all the year, and it is received into a fine bason 150 feet square, where it is collected for the use of the neighbouring gardens. Its latitude was found by Mr Bruce to be $14^{\circ} 6' 36''$ north.

On the 20th of January 1770, our traveller set out from Axum. The road was at first smooth and pleasant, but afterwards very difficult; being composed of stones raised one above another, the remains of a magnificent causeway, as he conjectures. As they pas-

sed farther on, however, the air was every where perfumed by a vast number of flowers of different kinds, particularly jessamine. One species of this, named *agam*, was found in such plenty, that almost all the adjacent hills were covered by it; the whole country had the most beautiful appearance; the weather was exquisitely fine, and the temperature of the air agreeable. In this fine country, however, Mr Bruce had the first opportunity of beholding the horrible barbarity of the Abyssinians, in cutting off pieces of flesh from the bodies of living animals, and devouring them raw; but notwithstanding this extreme cruelty, they have the utmost horror and religious aversion at pork of every kind; insomuch that Mr Bruce durst not venture to taste the flesh of a wild boar, just after having assisted in the destruction of five or six.

During the remaining part of the journey from Adowa to Siré, the country continued equally beautiful, and the variety of flowers and trees greatly augmented; but as a report was propagated that Ras Michael had been defeated by Fasil, they now met with some insults. These, however, were but trifling; and on the 22d in the evening they arrived safely at Siré, situated in N. Lat. $14^{\circ} 4' 35''$.

This town is still larger than Axum; but the houses are built of no better materials than clay, and covered with thatch; the roofs being in the form of cones, which indeed is the shape of all those in Abyssinia. It stands on the brink of a very steep and narrow valley, through which the road is almost impassable. It is famous for a manufacture of cotton cloth, which, as we have already observed, passes for money throughout the whole empire. At some times, however, beads, needles, antimony, and incense, will pass in the same way. The country in the neighbourhood is extremely fine; but the inhabitants are subject, by reason of the low situation, to putrid fevers. On leaving it on the 24th, our travellers passed through a vast plain, where they could discern no hills as far as the eye could reach, excepting some few detached ones standing on the plain, covered with high grass, which the inhabitants were then burning. The country to the northward is flat and open. In the way to Gondar, however, lies that ridge of mountains called *Samen*; of which one named *Lamalmon* is the most remarkable, and by some supposed to be the highest in Abyssinia. Betwixt Siré and these mountains the river Tacazzé runs, which, next to the Nile, is the largest in Abyssinia. Mr Bruce informs us that it carries near one third of the water which falls on the whole empire; and when passing it, he saw the marks of its stream, the preceding year, 18 feet perpendicular above the bottom; nor could it be ascertained whether this was the highest point to which it had reached. It has its source in the district of Angot, rising from three sources like the Nile, in a flat country, about 200 miles to the S. E. of Gondar. It is extremely pleasant; being shaded with fine lofty trees, the water extremely clear, and the banks adorned with the most fragrant flowers. At the ford where they crossed, this river was fully 200 yards broad, and about three feet deep; running very swiftly over a bottom of pebbles. At the very edge of the water the banks were covered with tamarisks, behind which grew tall and stately trees, that never lose their leaves. It abounds with fish; and is inhabited by crocodiles and hippopotami;

Abyssinia

Monstrous barbarity the Abyssinians.

scribed.

Tacazzé river described.

hippopotami; the former of which frequently carry off people who attempt to cross the river upon blown-up skins. The neighbouring woods are full of lions and hyænas. The Tacazze is marked by Mr Bruce in his map as a branch of the Astaboras, which falls into the Nile. The latitude of the ford was found to be 13° 42' 45".

This river was passed on the 26th of January; after which our travellers entered into the country of Samen; the governor of which, Ayto Tesfos, had never acknowledged the authority of Ras Michael, nor any of the emperors set up by him since the death of Ioas. The country therefore was hostile; but the uncertainty of the event of the war, and the well-known severity of Michael's disposition, preserved our traveller and his company from any insult, excepting a feeble and unsuccessful attempt to extort money. Here Mr Bruce observes that the people were more flat nosed than any he had hitherto seen in Abyssinia. The path among the mountains was for the most part exceedingly dangerous, having a precipice of vast height close by it which way soever you turn. The mountains appeared of very extraordinary shapes; some being like cones; others high and pointed, like columns, pyramids, or obelisks. In one place a village was observed in such a dangerous situation, that scarce the distance of a yard intervened between the houses and a dreadful precipice. Below it is a plain of about a mile square, covered with citron and lemon trees. A river named *Mai-Lumi* rises above this village, and falls into the wood, where it divides into two; one branch surrounding the north and the other the south part of the plain; then falling down a rock on each side, they unite; and having run about a quarter of a mile farther, the stream is precipitated in a cataract 150 feet high. The lions and hyænas were very numerous among these mountains, and devoured one of the best mules our travellers had. The hyænas were so bold, that they stalked about as familiarly as dogs, and were not intimidated by the discharge of fire arms. Their voracity was such, that they ate the bodies of those of their own species which our travellers had killed in their own defence.

On the 7th of February they began to ascend La-malmon by a winding path scarcely two feet broad, on the brink of a dreadful precipice, and frequently intersected by the beds of torrents, which produced vast irregular chasms in it. After an ascent of two hours, attended with incredible toil, up this narrow path, they came to a small plain named *Kedus* or *St Michael*, from a church of that name situated there. This plain is situated at the foot of a steep cliff, terminating the western side of the mountain, which is as perpendicular as a wall, with a few trees on the top. Two streams of water fall down this cliff into a wood at the bottom; and as they continue all the year round, the plain is thus preserved in continual verdure. The air is extremely wholesome and pleasant. On ascending to the very top of the mountain, where they arrived on the 9th of February, our travellers were surprised to find, that though from below it had the appearance of being sharp pointed, it was in reality, a large plain, full of springs, which are the sources of most rivers in this part of Abyssinia. These springs boil out of the earth, sending forth such quantities of water as are sufficient to turn a mill. A perpetual verdure prevails;

and it is entirely owing to indolence in the husbandman if he has not three harvests annually. La-malmon stands on the north-west part of the mountains of Samen; but though higher than the mountains of Tigré, our author is of opinion that it is considerably inferior to those which are situated on the south-east. The plain on the top is altogether impregnable to an army, both by reason of its situation and the plenty of provisions it affords for the maintenance of its inhabitants; even the streams on the top are full of fish. Here the mercury in the barometer stood at 20 $\frac{1}{2}$ inches.

During the time our travellers remained at La-Journey to malmon, a servant of Ras Michael arrived to conduct them safely to the capital, bringing a certain account of the victory over Fasil: so that now the difficulties and dangers of their journey were over. The country appeared better cultivated as they approached the capital; and they saw several plantations of sugar canes which they grow from the seed. In some places, however, particularly in Woggora, great damage is done by swarms of ants, rats, and mice, which destroy the fruits of the earth. Mr Bruce had already experienced the mischief arising from a small species of ant, whose bite was not only more painful than the sting of a scorpion, but which issued out of the ground in such numbers as to cut in pieces the carpets and every thing made of soft materials to which they could have access.

When Mr Bruce approached the capital, he was dressed like a Moor: and this dress he was advised to keep until he should receive some protection from government; his greatest, indeed his only, danger arising from the priests, who were alarmed at hearing of the approach of a Frank to the capital. This was the more necessary, as the emperor and Michael Ras were both out of town. For this reason also he took up his residence in the Moorish town at Gondar; which is very large, containing not fewer than 3000 houses. The only inconvenience he underwent here was the not being allowed to eat any flesh: for we have already taken notice of a law made by one of the emperors, that none of his subjects should eat flesh but such as had been killed by Christians: and a deviation from this would have been accounted equal to a renunciation of Christianity itself. Here he remained till the 15th of February; when Ayto Aylo waited upon him, and addressed him in the character of physician, which he had assumed. By this nobleman he was carried to the palace of Koscam, and introduced to the old queen. His advice was required for one of the royal family who was ill of the smallpox; but a saint had already undertaken his cure. The event, however, proved unfortunate; the patient died, and the saint lost his reputation. Our limits will not allow us to give any particular account of the steps by which Mr Bruce arrived at the high degree of reputation which he enjoyed in Abyssinia. In general, his success in the practice of medicine; his skill in horsemanship and the use of fire-arms, which by his own account must have been very extraordinary; his prudence in evading religious disputes; as well as his personal intrepidity, and presence of mind, which never once failed him, even in the greatest emergencies; all conspired to render him agreeable to people of every denomination. By the king he was promoted to the government of Ras-el-Feel, was his

N constant

Abyssinia. constant attendant on all occasions, and was with him in several military expeditions; but never met with any opportunity of distinguishing his personal valour, though he had the command of a body of horse at one of the battles fought at a place named *Serbraxos*. Thus honoured and employed, he had an ample opportunity of exploring the sources and cataracts of the Nile, as well as the geography and natural products of the whole country; obtaining also leave at last to return home. We cannot, however, praise the benevolence of his spirit at his departure. It has already been observed, that he was in some danger from the priests on his first arrival, on account of their suspecting him to be a Jesuit; for that is the meaning which they affix to the word *Frank* or *European*. As he constantly attended the established worship of the country, however, and carefully avoided all disputes on the subject of religion, he became at last not only unsuspected, but very intimate with many of the principal ecclesiastics. From one of these, named *Tensa Christos*, he asked a benediction immediately before he departed; which piece of unexpected humility so affected the priest, that it brought tears in his eyes. The benediction was conveyed in the simple form, "God bless you." A troop of inferior priests who attended would needs bless him also; and probably were pleased at having it in their power to bestow a benediction publicly on a man of such consequence: but to the blessings of these poor monks Mr Bruce replied in *English*, "Lord send you all a halter, as he did Abba Salama!" This Abba Salama had been an ecclesiastic of great consequence; but of a very dissolute life, and at last hanged for his crimes. The monks imagined he had been recommending them to their patriarch Abba Salama, and with great devotion answered "Amen."

Event of the war before he left the country.

The history of the war after Mr Bruce's arrival is related at great length in his work. The king Tecla Haimanout still kept his ground, and was at last acknowledged by almost the whole empire, though success did not always attend his arms. An usurper, named *Socinius*, was reduced and made a servant in the king's kitchen; but was afterwards hanged for theft. Ras Michael, notwithstanding all his skill in military affairs, was not able to get the better of Fasil; and his excessive cruelty, avarice, and ambition disgusted every one. An attempt was even made to assassinate him; and his spiritual friend (Michael the archangel, according to his own report, or the devil, according to that of the Abyssinians) at last forsook him; so that he was carried off prisoner by a party of the rebels. After this misfortune he was much dejected, imputing it to the want of the spiritual assistance just mentioned, and which it seems had withdrawn itself some time before. His wife Ozoro Esther, whom Mr Bruce characterizes as the handsomest woman he ever saw, was in great favour with the king at the time our traveller left Abyssinia. As the king himself was a handsome young man, there is no improbability in supposing with Mr Bruce, that "they were not insensible to each other's merits;" and as she was sometimes honoured with a *private audience*, where Michael himself "bore no part in the conversation," we shall conclude our history of this singular empire by a conjecture, that soon after Mr Bruce's departure, Michael either died by course of nature, he being then very old, or was cut

off by his enemies; on which Tecla Haimanout, having fully settled the affairs of his empire, became possessed of the beautiful Ozoro Esther, and commenced his reign with great glory.

With regard to the geographical description of ancient Ethiopia, little can be said; as not even the boundaries of the empire itself, much less those of the particular districts which composed it, were known. The ancient writers, however, agreed that it was very mountainous: but they mention no mountains of any consequence excepting Garbata and Elephas, whose situation is not well ascertained, though it is generally supposed that they answer to the mountains of Tigré. The most noted cities were Axum, Napata, Premis or Premnis, Melis, Mondus, Abalis, Mosylon, Caloe, Opone, &c.

The nations which inhabited ancient Ethiopia have already been enumerated; and it is not to be supposed that all, or indeed any two of them, would agree in many respects. The ancient historians, however, give the following information. They had many laws which were very different from those of other nations; especially their laws relating to the election of kings. The priests chose the most reputable men of their body, and drew a large circle around them, which they were not to pass. A priest entered the circle, running and jumping like an *Egipan* or satyr. He of those that were enclosed in the circle who first caught hold of the priest, was immediately declared king; and all the people paid him homage, as a person intrusted with the government of the nation by Divine Providence. The new-elected king immediately began to live in the manner which was prescribed to him by the laws. In all things he exactly followed the customs of the country; he paid a most rigid attention to the rules established from the origin of the nation, in dispensing rewards and punishments. The king could not order a subject to be put to death, though he had been capitally convicted in a court of justice, but he sent an officer to him, who showed him the signal of death. The criminal then shut himself up in his house, and was his own executioner. It was not permitted him to fly to a neighbouring country, and substitute banishment for death; a relaxation of the rigour of the law, with which criminals were indulged in Greece.

We have the following extraordinary information with regard to the death of many of their kings: The priests of Meroë, who had acquired great power there, when they thought proper dispatched a courier to the king to order him to die. The courier was commissioned to tell him, that it was the will of the gods, and that it would be the most heinous of crimes to oppose an order which came from *them*. Their first kings obeyed these groundless despotical sentences, though they were only constrained to such obedience by their own superstition. Ergamenes, who reigned in the time of Ptolemy the second, and who was instructed in the philosophy of the Greeks, was the first who had the courage to shake off this iniquitous and sacerdotal yoke. He led an army against Meroë, where, in more ancient times, was the Ethiopian temple of gold; when he put all the priests to the sword, and instituted a new worship.

The friends of the king had imposed on themselves a very singular law, which was in force in the time of Diodorus Siculus. When their sovereign had lost the

Abyssinia.

Geography of ancient Ethiopia.

Customs of the inhabitants.

Diod. Sic. p. 101, 102.

Abyssinia. use of any part of his body, by malady, or by any other accident, they inflicted the same infirmity on themselves; deeming it, for instance, shameful to walk straight after a lame king. They thought it absurd not to share with him corporeal inconveniences; since we are bound by the ties of mere friendship to participate the misfortunes and prosperity of our friends. It was even customary among them to die with their kings, which they thought a glorious testimony of their constant loyalty. Hence the subjects of an Ethiopian king were very attentive to *his* and their common preservation; and therefore it was extremely difficult and dangerous to form a conspiracy against him.

The Ethiopians had very particular ceremonies in their funerals. According to Ctesias, after having salted the bodies, they put them into a hollow statue of gold which resembled the deceased; and that statue was placed in a niche on a pillar which they set up for that purpose. But it was only the remains of the richest Ethiopians that were thus honoured. The bodies of the next class were contained in silver statues; the poor were enshrined in statues of earthen ware.

Lib. iii. Herodotus * informs us, that the nearest relations of the dead kept the body a year in their houses, and offered sacrifices and first fruits during that time to their deceased friend; and at the end of the year, they fixed the niche in a place set apart for the purpose near their town.

The Ethiopians made use of bows and arrows, darts, lances, and several other weapons, in their wars, which they managed with great strength and dexterity. Circumcision was a rite observed amongst them, as well as among the Egyptians, from very early antiquity; though which of these nations first received it, cannot certainly be known. The Ethiopian soldiers tied their arrows round their heads, the feathered part of which touched their foreheads, temples, &c. and the other projected out like so many rays, which formed a kind of crown. These arrows were extremely short, pointed with sharp stones instead of iron, and dipped in the *virus* of serpents, or some other lethiferous poison, inasmuch that all the wounds given by them were attended with immediate death. The bows from which they shot these arrows were four cubits long; and required so much strength to manage them, that no other nation could make use of them. The Ethiopians retreated fighting, in the same manner as the Parthians; discharging volleys of arrows with such dexterity and address, whilst they were retiring full speed, that they terribly galled the enemy. Their lances or darts were of an immense size, which may be deemed a farther proof of their vast bodily strength.

Thus far chiefly with regard to the Ethiopians who lived in the capital, and who inhabited the island of Meroë, and that part of Ethiopia which was adjacent to Egypt.

There were many other Ethiopian nations, some of which cultivated the tracts on each side of the Nile, and the islands in the middle of it; others inhabited the provinces bordering on Arabia; and others lived more towards the centre of Africa. All these people, and among the rest those who were born on the banks of the river, had flat noses, black skins, and woolly hair. They had a very savage and ferocious appearance; they were more brutal in their customs than in

their nature. They were of a dry adust temperament; their nails in length resembled claws: they were ignorant of the arts which polish the mind: their language was hardly articulate; their voices were shrill and piercing. As they did not endeavour to render life more commodious and agreeable, their manners and customs were very different from those of other nations. When they went to battle, some were armed with bucklers of ox hides, with little javelins in their hands; others carried crooked darts; others used the bow; and others fought with clubs. They took their wives with them to war, whom they obliged to enter upon military service at a certain age. The women wore rings of copper at their lips.

Some of these people went without clothing. Sometimes they threw about them what they happened to find, to shelter themselves from the burning rays of the sun. With regard to their food, some lived upon a certain fruit, which grew spontaneously in marshy places; some ate the tenderest shoots of trees, which were defended by the large branches from the heat of the sun; and others sowed Indian corn and lotos. Some of them lived only on the roots of reeds. Many spent a great part of their time in shooting birds; and as they were excellent archers, their bows supplied them with plenty. But the greater part of this people were sustained by the flesh of their flocks.

The people who inhabited the country above Meroë made remarkable distinctions among their gods. Some, they said, were of an eternal and incorruptible nature, as the sun, the moon, and the universe; others having been born among men, had acquired divine honours by their virtue, and by the good which they had done to mankind. They worshipped Isis, Pan, and particularly Jupiter and Hercules, from whom they supposed they had received most benefits. But some Ethiopians believed that there were no gods; and when the sun rose, they fled into their marshes, execrating him as their cruellest enemy.

These Ethiopians differed likewise from other nations in the honours which they paid to their dead. Some threw their bodies into the river, thinking that the most honourable sepulchre. Others kept them in their houses in niches: thinking that their children would be stimulated to virtuous deeds by the sight of their ancestors; and that grown people, by the same objects, would retain their parents in their memory. Others put their dead bodies into coffins of earthen ware, and buried them near their temples. To swear with the hand laid upon a corpse, was their most sacred and inviolable oath.

The savage Ethiopians of some districts gave their crown to him who of all their nation was best made. Their reason for that preference was, that the two first gifts of heaven were monarchy and a fine person. In other territories, they conferred the sovereignty on the most vigilant shepherd; for he, they alleged, would be the most careful guardian of his subjects. Others chose the richest man for their king; for he, they thought, would have it most in his power to do good to his subjects. Others, again, chose the strongest; esteeming those most worthy of the first dignity who were ablest to defend them in battle.

The Jesuit missionaries were the first who gave any Account of information to the Europeans concerning this country; the missionaries.

Abyssinia. and indeed, excepting them and the late accounts by Mr Bruce, we have no other source of information concerning it. Louis XIV. of France appointed six Jesuits to this mission, and furnished them with suitable presents for the emperor and the principal nobility. The admission of these missionaries was facilitated by a dangerous scorbutic disorder, which had attacked Yassous and his son, and for which they wished to have the advice of an European physician. Maillet, the French consul at Cairo, wishing the Jesuits to have the honour of the mission, disappointed the views of Friars Paschal and Anthony, two Franciscans, who were first thought of, and recommended Charles Poncet, a Frenchman, who had been bred a chemist and apothecary, and Father Brevedent as his servant, to Hagi Ali, a Mahometan factor at Cairo, for the desired purpose. The Franciscans attempted the destruction of Poncet and his attendants; but Poncet arrived safe at Gondar on the 21st of July, 1699, and having perfectly cured his royal patient, set out on the 2d of May, 1700, on his return for Europe, and arrived in safety at Masuah. Brevedent died at Gondar soon after their arrival. An embassy on the part of the Abyssinian monarch was defeated by the interference of Maillet; but the Jesuits concerted another mission from France, and the person appointed as ambassador was M. de Roule, vice-consul at Damietta. This mission was very improperly conducted; the merchants at Cairo opposed it; the Franciscans obstructed it, and it terminated in the murder of the ambassador in the province of Sennaar.

The missionaries confirm what is said by the ancients, that Abyssinia is a very mountainous country. The provinces of Begemder, Gojam, Waleka, Shoa, &c. according to them, are only one continued chain of mountains. Many of them were said to be of such enormous height, that the Alps and Pyrenees are but mole-hills in comparison of them. Those called *Aorni* were said to be of this kind; but Mr Bruce informs us, that these accounts are greatly exaggerated. Amongst those mountains, and even frequently in the plains, there are many steep and craggy rocks to be met with of various and whimsical shapes; some of them so smooth, that men and oxen are raised to the top by means of engines. The tops of these rocks are covered with woods and meadows, full of springs and streams of water; of which Mr Bruce has given us an account in his description of Lamalmon. The most remarkable of these, according to the authors we are now speaking of, is that called *Amba Geshen*, mentioned in the course of this article as one of the mountains used for a prison to the princes of the blood. Its top is described as only half a league in breadth, though it is said that it would require near half a day to go round it.

Mr Bruce's account of its divisions. Modern Ethiopia, or *Abyssinia*, as it is now called, is divided, according to Mr Bruce, into two parts, named *Tigré* and *Amhara*; though this rather denotes a difference in the language than the territory of the people. The most easterly province properly so called is Masuah. It is of considerable length, but no great breadth; running parallel to the Indian ocean and Red sea, in a zone of about 40 miles broad, as far as the island MASUAH. The territories of the Baharnagash include this province as well as the districts of Azab and Habab. In the former are mines of fossil salt, which substance in Abyssinia passes current instead of

money. For this purpose the mineral is cut into square solid pieces about a foot in length. Here also is a kind of mint from which great profits are derived. The Habab is likewise called the land of the *Agaazi* or Shepherds; who speak the language called *Geez*, and have had the use of letters from the most early ages. This province was formerly taken by the Turks, when the rebellious Baharnagash Isaac called them to his assistance against the emperor Menas. From that time the office fell into disrepute, and the Baharnagash at present has much less power than formerly. The province of Masuah is now governed by a Mahometan prince or officer called a *naybe*.

Abyssinia. Tigré is bounded on the east by the territories of the Baharnagash, of which the river Mareb is the boundary on the east, and the Tacazze on the west. It is about 200 miles long from north to south, and 120 broad from west to east. All the merchandise sent across the Red sea to Abyssinia, or from Abyssinia across the Red sea, must pass through this province, so that the governor has his choice of it as it goes along. Thus the province itself is very wealthy; and as the Abyssinian fire-arms are brought from Arabia, the governors of Tigré, by purchasing quantities of them, may easily render themselves very powerful. No arms of this kind can be sent to any person without his permission; nor can any one buy till the governor has first had an offer.

Siré was some time ago united to Tigré, on account of the misconduct of its governor; but was disjoined from it at the time Mr Bruce was in Abyssinia, with the consent of Ras Michael, who bestowed the government of it upon his son. It is about 25 miles long, and as much in breadth. Its western boundary is the Tacazze.

Samen is a very mountainous province lying to the westward of the river Tacazze, about 80 miles long, and in some places 30 broad, though in most it is much narrower. It is mostly inhabited by Jews.

Begemder lies to the north-east of Tigré. It is about 180 miles long and 60 broad; bounded by the river Nile on the west. It comprehends the mountainous country of Lasta; and there are now several small governments dismembered from it. The inhabitants are fierce and barbarous, but reckoned the best soldiers in Abyssinia; and it is said that this province with Lasta can furnish 45,000 horsemen. It abounds with iron mines, which in Abyssinia would be very valuable if properly managed. It is also well stored with beautiful cattle. Near the south end it is cut into vast gullies, seemingly by floods, of which we have no account. This province is reckoned the great barrier against the incursions of the Galla; and though they have often endeavoured to make a settlement in it, they have never yet found it practicable. Several of their tribes have been cut off in the attempt.

Next to Begemder is the province of Amhara, in length about 120 miles, and somewhat more than 40 in breadth. It is very mountainous; and the men are reckoned the handsomest in all Abyssinia. In this province is the mountain or rock Geshen, formerly the residence of the royal family. This province is parallel to Begemder on the south; being separated from it by the river Bashilo. On the west it is bounded by the Nile. The river Geshen is another boundary.

Walaka

Abyssinia.

Walaka lies between the rivers Geshen and Samba. It is a low unwholesome province, having Upper Shoa to the southward. It was in this province that the only surviving prince of the family of Solomon was preserved after the massacre by Judith, formerly mentioned; and on this account great privileges were conferred upon the inhabitants, which in some degree continue to this day. The governor is considered as an ally, rather than a subject, of the emperor of Abyssinia; and to preserve his independency, he has allowed the Galla to surround his province entirely, yielding up to them the territory of Walaka above mentioned. Trusting to the valour of his own people, he is under no apprehension of his barbarous neighbours the Galla. This province is also remarkable for the monastery of Debra Libanos, where the famous saint Tecla Haimanout, the founder of the power of the clergy, was bred.

Gojam is remarkable for having in it some of the sources of the Nile. It is bounded on the north by the high mountains of Amid Amid, on the south by the river Nile, on the west by another river named *Gult*, and on the east by the river Temci; on the north-east it has the kingdom of Damot. It is about 40 miles long from north to south, and somewhat more than 20 in breadth from east to west. It is very populous, but the men are accounted the worst soldiers in Abyssinia. There is great plenty of very beautiful cattle.

Beyond the mountains of Amid Amid on the east lies the country of the Agows; on the west it has Buré, Umbarma, and the country of the Gongas; on the south, those of Damot and Gafat; and Dingleber on the south.

Dembea occupies all the space along the lake of the same name, from Dingleber below the mountains bounding Guesque and Kuara. Mr Bruce is of opinion, that the lake has formerly overflowed the whole of it; and the decrease of this lake he brings as an instance of the decrease of large pools throughout the world.

To the south of Dembea is the country of Kuara, bordering on that of the Shangalla, the Macrobi of the ancients. The neighbouring countries, inhabited by Pagan savages, produce gold, which is introduced in plenty into this province. None is produced in the province itself, nor indeed does Mr Bruce mention any part of Abyssinia where gold is naturally found. In the lower part of this country is a colony of Pagan blacks named *Ganjar*; derived, according to our author, from the black slaves who came into the country with the Arabs after the invasion of Mahomet. These deserting their masters, formed the colony we speak of; but it is now more increased by vagabonds from other parts than by the multiplication of the inhabitants themselves. The governor of this country is one of the great officers of state: he has kettle-drums of silver, which he is allowed to beat through the streets of Gondar; a privilege allowed to none but himself. This privilege was conferred upon the first governor by David II. who conquered the country.

The frontier countries of Narea, Ras-el-Feel, Tchelga, &c. are wholly inhabited by Mahometans, and the government of them is usually given to strangers. The country is very hot, unwholesome, and covered with thick woods. The people are fugitives from all

nations, but excellent horsemen; making use of no other weapon but the broadsword, with which, however inadequate we might suppose the weapon to be, they will attack the elephant or rhinoceros.

According to Mr Bruce the empire of Abyssinia is bounded on the south by a vast chain of mountains, extending with very little interruption from 34° to 44° E. Long. and between 8° and 9° N. Lat. In more prosperous times it extended beyond these southward, particularly into the kingdom of Adel; but the mountains just mentioned are undoubtedly to be reckoned its natural boundaries on this side. On the east and north-east it has the Red sea, and on the south-east the kingdom of Adel. On the west and north its boundaries are less distinctly marked; having on both these quarters the barbarous kingdom of Sennaar, whose limits will no doubt frequently vary according to the fortune of war betwixt the two princes. From Arkeeko, situated near the foot of the basaltic mountains, in about 15° 30' N. Lat. it extends to near 7° N. Lat. where the mountains of Caffa, the most southerly province of Abyssinia, terminate. Along the coast of the Red sea lie the territories inhabited by the Hazorta Shiho, the district of Engana Shiho, and the kingdom of Dancali, including the territory of Azab and the salt pits already mentioned. To the westward of these is the province or kingdom of Tigré, including the country of the Dobas, part of the kingdom of Bali, and that of Dawaro. Still farther west are those of Siré, Lasta, Amhara, the greatest part of Bali, and part of Fatigar, which last reaches beyond the mountains. Proceeding still in the same direction, we come to Tcherkin, Tchelga, Abargale, Salao, Begemder, Shoa, and Ifat; reckoning always from north to south; Tcherkin, for instance, being to the northward of Tchelga, &c. Shoa extends a considerable way to the westward; so that, besides Ifat, it has to the south of it also the kingdoms of Hade and Cambut; the latter extending beyond the southern ridge of mountains. To the westward are Ras-el-Feel, Dembea, Gojam, and Damot; and beyond these are the kingdoms of Bembea, Bizamo, Gooderoo, and Gu-raq; those of Narea or Enarea and Caffa occupying the south-west corner of the empire.

The climate of Abyssinia, though, like other parts of the torrid zone, it was formerly thought to be uninhabitable, is not only tolerable, but in general temperate and healthy. In this respect, however, the uneven surface of the country exposes different situations to the effects of heat and cold, of dryness and moisture, and of a free circulation or a stagnation of the atmosphere, in very various degrees. On the mountains, and in the higher parts of the country, the sky is clear and serene, the air is cool and refreshing, and the people are healthy and sprightly; whilst those who live in some of the valleys, in the vicinity of marshes, and in sandy deserts, experience the pernicious influence of excessive heat, and of a moist, stagnant, and suffocating air; so that the climate depends upon soil and situation as much almost as upon the latitude. Mr Bruce observes, that on the highest mountain of the ridge called Lamalmon, the thermometer stood at 32° in the depth of winter, the wind being north-west; clear and cold, but attended only with hoar frost. This, he adds, vanished into dew after

Climatic.

Abyssinia. after a quarter of an hour's sun; nor did he ever see any sign of congelation of water upon the top of the highest mountains. The barometer stood at 19° 9' at noon of the same day, and the thermometer was at 78°. He observed hail to lie for three hours in the forenoon on the mountains of Amid Amid. The range of the barometer and thermometer, according to Mr Bruce's register kept at Gondar from February 19. 1770, to May 31. 1771, will appear from the following table.

	Barom.	Thermom.	Wind.
April 29. } 6½ A. M. }	22.11	69°	S.
Mar. 29. } 2¼ P. M. }	20.11	75°	E.
April 19. } 12 Noon. }		91°	W.N.W.
July 7. } 12 Noon. }	21.6	54¼°	W.

The rainy season commences in April or the beginning of May, when the sun becomes vertical, and ends in September. The rains generally cease about the 8th of September; a sickly season follows till they begin again, about the 20th of October; they then continue constant, but moderate till the 8th of November. All epidemic diseases cease with the end of these rains. In order to avoid the inconveniencies that attend the overflowing of their rivers during this season, as well as on account of the greater salubrity of elevated situations, the Abyssinians have built many of their towns and villages on the mountains. Their houses are generally very mean, consisting only of one story, and constructed with straw and laths, earth and lime; though there are some of stone and better materials. It is a mistaken notion, however, that they live in tents, and not in houses. In a climate like that of Abyssinia, subject to scorching weather for six months, and to deluges of rain, storms of wind, thunder and lightning, and hurricanes, such as are unknown in Europe, for the other six, it is not probable that they should choose to live in tents, after having known how to build such cities as Axum. In many of the towns and villages, the houses are separated by hedges, which being always green, and intermixed with flowers and fruit trees at certain distances, afford an agreeable prospect, and contribute also to their salubrity.

Diseases.

The inhabitants of Abyssinia are subject to violent fevers, which commonly prove fatal on the third day. Those who survive to the fifth day often recover, merely by drinking cold water, and by repeatedly throwing cold water upon them in their beds. The bark is the most effectual remedy; which in critical cases, says Bruce, should be frequently repeated in small doses, and perfect abstinence observed, unless from copious draughts of cold water. Another common disease in Abyssinia, is the tertian fever, which is in no respect different from our tertian, and is successfully treated in the same manner. All fevers terminate in intermittents, and if they continue long in dysenteries, which are always tedious, and very frequently mortal. Bark and ipecacuanha, in small quantities, water, and fruit not over ripe, have been found the most effectual remedies. The dysentery, commencing with a constant diarrhoea, is seldom cured, if it begins with the rainy season;

otherwise small doses of ipecacuanha either remove it, or change it into an intermittent fever, which yields to the bark. Another endemial disease is called *hanzeer*, the hogs or the swine, and is a swelling of the glands of the throat, and under the arms, which by ineffectual attempts for producing suppuration, and opening the tumours, becomes a running sore, and resembles the evil. In connection with this disorder, we may mention those swellings to which the whole body is subject, but more particularly the arms, thighs, and legs, sometimes accompanied with ulcers in the nose and mouth, which deface the smoothness of the skin, and which on this account are much dreaded by the Abyssinians. The two last diseases sometimes yield to mercurials; but the last is speedily and completely cured by antimonials. Another complaint afflicts those who are in the habit of drinking stagnant water. It is called *farenteit*, or the worm of Pharaoh, and appears in all parts of the body, but most frequently in the legs and arms. It is a worm with a small black head and a hooked beak, of a whitish colour, and a white body of a silky texture, resembling a small tendon. The natives seize it by the head, and wind it gently round a piece of silk, or a bird's feather, and thus by degrees they extract it without any inconvenience, or permanent scar. Mr Bruce suffered much from this complaint, and the breaking of the worm in the operation of extracting it. The most terrible of all the diseases of this climate is the elephantiasis. The cicuta, mercury, and tar-water, were unsuccessfully tried in this complaint; the greatest benefit was derived from whey made of cows milk. To the alternation of scorching heat and chilling cold, thin clothing, the use of stagnant putrid water for four months, and other such causes, these diseases may be partly, if not wholly ascribed. The smallpox was introduced into Abyssinia at the time of the siege of Mecca, about the year 356, and the Abyssinian army was the first victim to it.

The great difference of climate, owing to the vast extent and variety of elevation in different parts of this empire, is very perceptible in its soil and productions. The mountains in many places are not only barren, but altogether inaccessible, except by those who make it their constant practice to climb amongst them: and even by them they cannot be ascended without great difficulty and danger. The shapes of these mountains, as we have already had occasion to observe, are very strange and fantastical: exceedingly different from those of Europe; some resembling towers and steeples, while others are like a board or slate set up on end; the base being so narrow, and the whole mountain so high and thin, that it seems wonderful how it can stand. In the valleys, however, and flat parts of the country, the soil is excessively fruitful, though in the warmest places grain cannot be brought to perfection. Wine is also made only in one or two places; but the greatest profusion of fruits of all kinds is to be met with every where, as well as many vegetables not to be found in other countries. There is a vast variety of flowers, which adorn the banks of the rivers in such a manner as to make them resemble fine gardens. Among these a species of rose is met with, which grows upon trees, and is much superior in fragrance to those which grow on bushes. Sena, cardamom, ginger, and cotton,

Abyssinia. cotton, are likewise produced here in great quantities. Among the variety of rare plants to be met with in Abyssinia, Mr Bruce particularly describes the following.

plants described by Mr Bruce.

1. The papyrus, the ancient material for paper: which our author supposes to have been a native of Ethiopia, and not of Egypt as has been supposed. 2. Balessan, balm, or balsam plant; a tree growing to the height of 14 or 15 feet, and used for fuel along with other trees in the country. It grows on the coast of the Red sea, among the myrrh trees behind Azab, all the way to Babelmandel. This is the tree producing the balm of Gilead mentioned in Scripture. 3. The sassa, myrrh, and opocalpasum trees. These grow likewise along the coast of the Red sea. The sassa or opocalpasum is used in manufactures; and, according to our author, resembles gum *adragant*, probably *tragacanth*. The tree which produces it grows to a great size, and has a beautiful flower, scarce admitting of description without a drawing. 4. The ergett, a species of the mimosa, is of two kinds; one called *ergett y'dimmo*, or the bloody ergett, from the pink colour of its filaments; the other *ergett el krone*, or the horned ergett, with a flower resembling the acacia vera or Egyptian thorn. These were both found on the banks of a river named *Amo*, near the great lake Dembea. 5. Ensete, an herbaceous plant, growing in Narea, in swampy places; but is supposed to grow equally well in any other part of the empire, where there is heat and moisture sufficient. It forms a great part of the vegetable food of the Abyssinians. It produces a kind of figs, but these are not eatable. When used for food, it is to be cut immediately above the small detached roots, or perhaps a foot or two higher, according to the age of the plant. The green is to be stripped from the upper part till it becomes white; and when soft, it affords an excellent food when eaten with milk or butter. 6. Kolquall, a kind of tree, only the lower part of which is woody, the upper part being herbaceous and succulent. The flowers are of a beautiful golden colour, and the fruit turns to a deep crimson; so that the trees make a very beautiful appearance. The whole plant is full of a very acrid and caustic milk. 7. Rack is a large tree, growing not only in Abyssinia but in many places of Arabia Felix. Its wood is so hard and bitter, that no worm will touch it; for which reason it is used by the Arabs for constructing their boats. It grows, like the mangrove, among the salt-water of the sea, or about salt springs. 8. Gir-gir, or Geshe-el-aube, a kind of grass found about Ras-el-Feel, growing to the height of about three feet four inches. 9. The kantuffa, a very noxious species of thorn, much more troublesome than any with which we are acquainted, and growing to the height of eight or more feet. The flowers have a strong smell like the flower nignionet. 10. The gagnedi, is a short tree only about nine feet high, a native of Lamalmon. The flowers, which are yellow, and very beautiful, turn towards the sun like those of the helianthus. 11. The wanscy, a tree common throughout all Abyssinia, flowers exactly on the first day the rains cease. It grows to the height of 18 or 20 feet; having a thick bark and close heavy wood; the first part of which is white, but the rest of a dark colour. The flowers are of a beautiful white colour; but it does not appear to possess any other remarkable property, though it is held in great esti-

mation by the Abyssinians, and is even worshipped by the Galla. 12. The farek, or *Bauhinia acuminata*, grows in the country immediately adjacent to the sources of the Nile; being found by Mr Bruce scarce 400 yards distant from the fountain. 13. Kuara, is a beautiful tree, growing in the south and south-west parts of Abyssinia. It has a fruit like a bean, of a red colour, which in the early ages was made use of as a weight for gold and diamonds; and hence Mr Bruce is of opinion that the name of the imaginary weight carat is derived. 14. The walkuffa, grows in the hottest parts of Ethiopia. It is a flowering tree, with beautiful white blossoms, which do not appear till towards the middle of January. The flowers have no smell, and are accounted pernicious to bees. The wood is very heavy. 15. The wooginoos, or *Brucea antidysenterica*, is common throughout the whole empire, but principally on the sides of the valleys. It is a sovereign remedy against the dysentery, a very common and fatal disease in hot countries. Mr Bruce had experimental proof of its antidysenteric virtue. 16. Cusso, or *Banksia anthelmintica*, is a very beautiful and useful tree, being a strong anthelmintic, and used as such by the Abyssinians. Every person there, whether male or female, is troubled with that kind of worm called *ascarides*; a great number of which are evacuated every month, and the evacuation is promoted by an infusion of this plant. While taking this medicine, the patients sequester themselves from all their acquaintance, and keep close at home. It is said that the want of this medicine in other countries is the reason why the Abyssinians do not go out of their own country; or, if they do, that they are short-lived. Teff, is a kind of grain sown generally throughout Abyssinia; and constituting the bread commonly made use of by the inhabitants. They have indeed plenty of wheat, and are as skilful in forming it into bread as the Europeans; but this is only made use of by people of the first rank: however, the teff is sometimes of such an excellent quality, that the bread made from it is held in equal estimation with the finest wheat. From the bread made of this grain a sourish liquor called *bouza* is prepared, which is used for common drink like our small beer. A liquor of the same kind, but of inferior quality, is made from barley cakes. Some have been of opinion, that the use of teff occasions the worms above mentioned; but this is controverted by Mr Bruce. Nook, a plant not to be distinguished from our marigold, either in shape, size, or foliage, is also sown very generally over the country, and furnishes all Abyssinia with oil for the kitchen and other uses.

Abyssinia abounds with a vast variety of quadrupeds. Quadrupeds both wild and tame. Immense numbers of cattle everywhere present themselves, some of them the most beautiful in the world. Some have monstrous horns, said to be capable of holding 10 quarts each; but this, as our author informs us, is a disease which proves fatal to them. Buffaloes are here met with in great numbers, and are very fierce and untractable; but there are no such animals as carnivorous bulls, which have been said to exist in this and other internal parts of Africa. Antelopes and other wild animals are met with in great numbers in the uncultivated parts; feeding chiefly on the leaves of trees. They abound most of all, however, in those parts which have been once cultivated,

Abyssinia. cultivated, but since desolated by the calamities of war; and where wild oats abound in such quantities as to hide them from pursuit. Hyænas, lions, foxes, jackals, wild boars, &c. are also found, as well as the elephant, rhinoceros, camelopard, and others of the larger and more uncommon kinds. Great havoc is made in the cultivated fields by multitudes of baboons, apes, rats, and mice. There is plenty of hares; but these being reckoned unclean, as well as wild boars, are not used as food. The rivers abound with crocodiles and hippopotami, at least the Nile, and those large streams which flow into it; but a great number have water in them only during the rainy season, and these have neither fish nor any animal that feeds upon them.

Birds.

The number of birds in this country is immense; nor are those of the carnivorous kind at all deficient. Great numbers of eagles, vultures, hawks, and others of that kind are met with, and come punctually every year after the tropical rains have ceased. They feed at first upon the shell fish which are met with in great quantities on the edges of the deserts, where they had lived in the salt springs; but, being forced from their natural habitations when these springs were swelled by the rains, are afterwards left to perish on dry land. When these fail, their next resource is from the carcasses of the large animals, such as the elephant and rhinoceros, which are killed in the flat country by the hunters. Their next supply is the multitude of rats and field mice which infest the country after harvest. The vast slaughter of cattle made by the Abyssinian armies, the multitude of persons killed whose bodies are allowed to rot on the field of battle, &c. furnish them also with another resource. These supplies, however, all fail at the beginning of the rainy season, when the hunters and armies return home, and the vast quantity of water which continually overflows the ground renders it impossible for them to find any other food.

There are other birds which feed upon insects, and multitudes which live on grain or seeds of various kinds; all of which are amply supplied by the immense quantity of fruits and berries which grow in Abyssinia, and are ripe at all seasons of the year. A very remarkable particular concerning this is, that the trees which bear fruit all the year round do not carry it always in the same place. The west side is that which blossoms first, and where of consequence the fruit first comes to perfection; the south side succeeds, and goes through the same process: after which, the north blossoms in like manner; and last of all is the east side, which produces flowers and fruit towards the beginning of the rainy season. All the trees of Abyssinia are ever-green; and their leaves are of a thick leathery consistence, and highly varnished, to enable them to resist the violent rains which fall during a certain season. The granivorous birds have likewise this advantage, that the rains do not fall at the same time all over the country. It is intersected by a chain of mountains that divide the seasons also; so that they have but a short way to fly in order to become birds of passage, and supply themselves with such food as is necessary for them beyond the mountains. All the pigeons, of which there are many species, are birds of passage, excepting one kind. The owls are ex-

tremely large and beautiful, but few in number. There is a great variety of swallows, several kinds of which are unknown in Europe; but, says our author, "those that are common in Europe appear in passage at the very season when they take their flight from thence. We saw the greatest part of them in the island of Masuah, where they lighted and tarried two days, and then proceeded with moon-light nights to the south-west." The large birds which reside constantly among the mountains of Samen and Tarantia have all their feathers tubular, the hollow part being filled with a kind of yellow dust which issues out in great abundance on hunting them. This was particularly observed by Mr Bruce in a species of eagle, which he calls the *golden eagle*; and the dust being viewed through a microscope with a very strong magnifying power, appeared like fine feathers. The crows are spotted white and black, almost in equal proportions. The raven has his feathers intermixed with brown, the tip of his beak white, and a figure like a cup or chalice of white feathers upon his head. Our author saw no sparrows, magpies, nor bats; neither are there many water-fowl, especially of the web-footed kind: but there are vast numbers of storks, which cover the plains in May, when the rains become constant. There are no geese, excepting one species called the *golden goose* or *goose of the Nile*, which is common all over Africa; but there are snipes in all the marshes.

Our author describes very few fishes; though he says that an account of these, and other marine productions of the Red sea, which he has painted and collected, would occupy many large volumes, and the engraving cost a sum which he could not by any means afford. Among others, he mentioned the *torpedo* and the *binny*, which latter is good food, and grows to a large size; that from which he took the drawing was about 32 pounds weight. Its whole body is covered with beautiful scales resembling silver spangles.

Locusts and a species of ants are extremely troublesome and pernicious in Abyssinia, but the fly by the natives called *tsaltsalya* is most destructive to cattle. Mr Bruce gives a particular description of a kind of lizard, and of the cerastes or horned serpent; but denies that serpents are numerous in Abyssinia, as almost all authors have supposed, and as we should be led naturally to suspect. He vouches also for the power that some persons have of enchanting serpents and scorpions, which in some is natural, in others communicated artificially by certain medicines. He prevailed upon those who knew the secret to prepare him by these means as they had done others; but, notwithstanding this assistance, he acknowledges, that when it came to the trial his heart always failed him.

The crown is hereditary in the line of Solomon, but it depends on the minister to choose the particular person who is to enjoy it; and as it is always his inclination to have the government in his own hands, he never fails to choose an infant, who is seldom suffered to live after he comes to the years of maturity. Thus perpetual wars and commotions take place, insomuch that the ravenous birds, as has been observed, find one great supply of food in the slaughters made by the Abyssinians of one another. All authors indeed agree that the devastations committed by the armies of this country are excessive; insomuch, that after a long encampment is removed,

Abyssinia.

Fishes.

Few serpents in Abyssinia.

The cause of civil wars.

Excessive destruction of armies.

Abyssinia. removed, nothing is to be seen all around the place where it was but bare earth. When an army marches through the country, says Mr Bruce, "an inconceivable number of birds and beasts of prey, especially the former, follow it from the first day of its march to its return; increasing always in proportion the more it advances into the country. An army there leaves nothing living behind, not even the vestige of a habitation; but fire and the sword reduce every thing to a wilderness and solitude. The beasts and birds unmolested have the country to themselves, and increase beyond all possible conception. The slovenly manners of this savage people, who, after a battle, bury neither friends nor enemies; the quantity of beasts of burthen that die perpetually under the load of baggage, and variety of mismanagement; the quantity of offal, and half-eaten carcasses of cows, goats, and sheep, which they consume in their march for sustenance; all furnish a stock of carrion sufficient to occasion contagious distempers, were there not such a prodigious number of voracious attendants who consume them almost before putrefaction. There is no giving the reader any idea of their number, unless by comparing them to the sand of the sea. While the army is in motion, they are a black canopy which extends over it for leagues. When encamped, the ground is discoloured with them beyond the sight of the eye; and all the trees are loaded with them."

immense number of birds which follow them.

Curious method of keeping off the hyænas from the king's palace.

Method of anointing and crowning the king.

The prodigious number of criminals executed for high treason, whose bodies are cut in pieces and thrown about the streets, invite the hyænas to the capital, in the same manner that the carrion of the camp invites the birds of prey to follow it. The method of keeping off these voracious animals is certainly very curious. "An officer (says Mr Bruce) called *Serach Massery*, with a long whip, begins cracking and making a noise worse than 20 French postillions at the door of the palace before the dawn of day. This chases away the hyænas and other wild beasts: this too is the signal for the king's rising, who sits in judgment every morning fasting; and after that, about eight o'clock, he goes to breakfast."

From these and other circumstances we should be apt to imagine that the Abyssinians, instead of becoming more civilized, were daily improving in barbarity. The king is anointed at his election with plain oil of olives; "which (says Mr Bruce) being poured upon the crown of his head, he rubs into his long hair indecently enough with both his hands, pretty much as his soldiers do with theirs when they get access to plenty of butter." In former times, however, matters seem to have been conducted with more decency. Socinjos, the greatest monarch that ever sat on the Abyssinian throne, was crowned, after having gained a great victory over the Galla, in a very different manner, and with the ceremonies which we are told were in use among the ancient kings of Tigré. At that time he had with him an army of about 30,000 men; and was besides attended by all the great officers dressed in the gayest manner, as well as by the ladies of the first quality in the empire. The king himself, dressed in crimson damask, with a great chain of gold about his neck, his head bare, and mounted on a horse richly caparisoned, advanced at the head of his nobility, passed the outer court, and came to the paved way before the church. Here he was met by a number of young girls,

daughters of the *ambares* or supreme judges, together with many noble virgins standing on the right and left of the court. Two of the noblest of these held in their hands a crimson cord of silk, somewhat thicker than common whip cord, stretched across from one company to another, as if to shut up the road by which the king was approaching the church. When this cord was prepared and drawn tight about breast-high by the girls, the king entered; advancing moderately quick, and showing his skill in horsemanship as he went along. Being stopped by the tension of the string, the damsels asked, Who he was? To this he answered, "I am your king, the king of Ethiopia." But they replied, "You shall not pass; you are not our king." He then retired some paces, and again presented himself. The question was again put, "Who he was?" To which he answered, "I am your king, the king of Israel." But the same reply was still given by the girls. The third time, on being asked, "Who he was?" he answered, "I am your king, the king of Sion;" and drawing his sword, he cut the cord asunder. The damsels then cried out, "It is a truth, you are our king; truly you are the king of Sion." On this they began to sing Hallelujah, and were joined by the whole army and the rest of the king's attendants. Amidst these acclamations the king advanced to the foot of the stair of the church, dismounted, and sat down upon a stone; which, in Mr Bruce's opinion, was plainly an altar of Anubis or the Dog-star. After the king, came a number of priests in proper order. The king was first anointed, then crowned, and accompanied half up the steps by the singing priests. He stopped at a hole made on purpose in one of the steps, where he was fumigated with myrrh, aloes, and cassia: after which divine service was celebrated; and he returned to the camp, where 14 days were spent in feasting and rejoicing.

Abyssinia.

Ceremonies of this kind are now given over on account of the expence. Our author was informed by Tecla Haimanout, that when he was obliged to retire into Tigré from his enemies, Ras Michael had some thoughts of having him crowned in contempt of his enemies; but by the most moderate calculations that could be made, it would have cost 20,000 ounces of gold, about 80,000l. sterling; on which all thoughts of it were laid aside.

The Abyssinians compute time by the solar year. Thirty days constitute their month, to which they add five days and a quarter, and thus they complete the year. The five days are added to the month of August, and to every fourth year they add a sixth day. They begin their year with the 29th or 30th of August, i. e. the kalends of September; the 29th of August being the first of their month Mascaram. The common epoch which the Abyssinians use is from the creation of the world, and they reckon 5500 years from the creation to the birth of Christ, rejecting the odd eight years of the Greeks, who make this period 5508 years. They have also many other epochs, such as from the council of Nice and Ephesus. In their ecclesiastical computations they make use of the golden number and epact. The first use of epacts amongst them was not earlier, according to Scaliger, than the time of Dioclesian; but Mr Bruce observes, that this is contrary to the positive evidence of Abyssinian history, which says expressly, that the epact was invented by

Mode of computing time.

Demetrius

Abyssinia. Demetrius of Alexandria. This Demetrius was the 12th patriarch of Alexandria, and elected about the 190th year of Christ, or in the reign of Severus, and consequently long before the time of Dioclesian. The Abyssinians have another mode of computing time, that is peculiar to themselves. They read the whole of the evangelists, in order, every year, in their churches; and when they speak of an event, they write or say, it happened in the days of Matthew; that is, in the first quarter of the year, whilst they were reading the gospel of St Matthew in their churches. They compute the time of the day in a very arbitrary manner. The twilight being very short, is selected for the beginning of their day; this they call Naggé, which comprehends the duration of twilight. Méset expresses the moment when the evening twilight begins. Mid-day is called Kater, which signifies culmination. All the other parts of time they describe, in conversation, by pointing at the place in the heavens where the sun was, when the event, which they are describing, happened.

With regard to the manners of the Abyssinians, they are represented by Mr Bruce as highly barbarous. Their continual warfare injures them to blood from their infancy; so that even children would not have the least scruple at killing one another, or grown up persons, if they were able. Many shocking instances of hardness of heart are related by our author in Tecla Haimanout himself, though otherwise an accomplished prince. Their cruelty displays itself abundantly in the punishments inflicted upon criminals, one of which is flaying alive, as has been already related of Woosheka. Cutting in pieces with a sabre is another; and this is performed, not by executioners, whose employment is reckoned disgraceful as in this country, but by officers and people of quality. So little is this thought of indeed in Gondar, the capital of the empire, that Mr Bruce happening to pass by an officer employed in this work, who had three men to dispatch, the officer called to him to stop till he had killed them all, as he wanted to speak to him upon a matter of consequence. Stoning to death is a capital punishment likewise common in this country; and usually inflicted on Roman Catholics if they happen to be found, or upon other heretics in religion.

Manners of the Abyssinians. It is not to be supposed that people who regard the lives of one another so little, will show much compassion to the brute creation. In this respect, how-

ever, the Abyssinians are cruel and savage beyond all people on the face of the earth. There are many instances of people eating raw fish or flesh, and we call them barbarous that do so; but what name shall we give to those who cut off pieces of flesh from animals while still living, and eat it not only raw but still quivering with life! He informs us, that when at no great distance from Axum, the capital of Tigré, he fell in with three soldiers "driving a cow. They halted at a brook, threw down the beast, and one of them cut a pretty large collop of flesh from its buttock; after which they drove the cow gently on as before." In another place he tells us, that the flesh was taken from the upper part of the buttock; that the skin was flapped over the wound, fastened with a skewer, and a cataplasm of clay put over all. But it may be asked, how could the animal travel after those muscles were cut which are necessary to its motions? In his description of their feasts there is more consistency; for there the animal is tied so that it cannot move: after stripping off the skin, the flesh of the buttocks is cut off in solid square pieces, without bones or much effusion of blood; and the prodigious noise the animal makes is a signal for the company to sit down to table. The flesh is then cut smaller, laid on pieces of bread, powdered with pepper and salt, and eaten. All this time the animal bleeds but little: but when the large arteries are cut and it expires, the flesh becomes tough; and the wretches who have the rest to eat, gnaw it from the bones like dogs!

The truth of Mr Bruce's account of these horrible barbarities, as well as of many other parts of his narrative, has been questioned. Later testimony proves, that the practice of cutting flesh from living animals for eating does exist in the country; but it does not seem to be common; nor does it appear that public feasts are conducted with such circumstances of monstrous cruelty. In a few other particulars, later travellers have qualified Mr Bruce's statements. But they at the same time bear testimony to the accuracy of his description of the country and its inhabitants, and to his knowledge of its history, and thus give additional authority to all that is important in his work. Under the article ABYSSINIA, in the SUPPLEMENT, an account is given of the new information furnished by Mr Salt's two journeys, and of the controversy regarding Bruce's accuracy.

Abyssinia. Their horrid manner of feeding.

A B Y

Abyssinian. ABYSSINIAN, in *Ecclesiastical History*, is the name of a sect in the Christian church, established in the empire of Abyssinia. The Abyssinians are a branch of the Copts or Jacobites; with whom they agree in admitting but one nature in Jesus Christ, and rejecting the council of Chalcedon: whence they are also called *Eutychians* or *Monophysites*, and stand opposed to the Melehetes. They are only distinguished from the Copts, and other sects of Jacobites, by some peculiar national usages. The Abyssinian sect or church is governed by a bishop or metropolitan styled *Abuna*, sent them by the Coptic patriarch of Alexandria residing at Cairo, who is the only person that ordains priests.

A B Y

The next dignity is that of Komos, or Hegumenos, who is a kind of arch presbyter. They have canons also, and monks: the former of whom marry; the latter, at their admission, vow celibacy, but with a reservation: these, it is said, make a promise aloud, before their superior, to keep chastity; but add in a low voice, *as you keep it*. The emperor has a kind of supremacy in ecclesiastical matters. He alone takes cognizance of all ecclesiastical causes, except some smaller ones reserved to the judges; and confers all benefices, except that of Abuna.

There are two classes of monks among the Abyssinians; those of Debra Libanos, and those of St Eustathius.

The

Abyssinia

Abyssinian. The latter are grossly ignorant. Their head is the superior of the convent of Mahebar Selassé, in the north-west part of Abyssinia, near Kuara and the Shangalla, towards Sennaar and the river Dender. The chief of the former is the Itchegue, who is ordained in the following manner. Two chief priests hold a white cloth or veil, over his head, a third repeats a prayer, and then they all lay their hands on his head, and join together in singing psalms. In turbulent times this Itchegue has more extensive influence than even the Abuna.—The monks do not live in convents, but in separate houses round their church; and each cultivates for himself a portion of the land which is assigned them as their property.—The churches are built on eminences, in the vicinity of running water, for the advantage of purifications and ablutions, according to the Levitical law, and are surrounded with rows of Virginia cedar. They are circular buildings with conical summits and thatched roofs, and encompassed on the outside with pillars of cedar, to which the roof projecting eight feet beyond the wall is fixed, and forms an agreeable walk in the hot or rainy season. The internal partition and arrangement of the church, is that prescribed by the Mosaic law; and many of the ceremonies and observances in their mode of worship, are obviously derived from the ceremonial rites of the Jewish religion.

The Abyssinians have at different times expressed an inclination to be reconciled to the see of Rome; but rather out of interest of state than any other motive. The emperor David, or the queen regent on his behalf, wrote a letter on this head to Pope Clement VII. full of submission, and demanding a patriarch from Rome to be instructed by: which being complied with, he publicly abjured the doctrine of Eutychius and Dioscorus in 1626, and allowed the supremacy of the pope. Under the emperor Sultan Seghed all was undone again; the Romish missionaries settled there, had their churches taken from them, and their new converts banished or put to death. The congregation *de propaganda* have made several attempts to revive the mission, but to little purpose.—The doctrines and ritual of this sectary form a strange compound of Judaism, Christianity, and superstition. They practise circumcision; and are said to extend the practice to the females as well as males: They observe both Saturday and Sunday as Sabbaths: they eat no meats prohibited by the law of Moses: women are obliged to the legal purifications; and brothers marry their brothers wives, &c. On the other hand, they celebrate the epiphany with peculiar festivity, in memory of Christ's baptism; when they plunge and sport in ponds and rivers; which has occasioned some to affirm that they were baptized anew every year. Among the saints days is one consecrated to Pilate and his wife; because Pilate washed his hands before he pronounced sentence on Christ, and his wife desired him to have nothing to do with the blood of that just person. They have four lents: the great one commences ten days earlier than ours, and is observed with much severity, many abstaining therein even from fish, because St Paul says there is one kind of flesh of men, and another of fishes. They allow of divorce, which is easily granted among them, and by the civil judge; nor do their civil laws prohibit polygamy itself. They have

at least as many miracles and legends of saints as the Romish church; which proved no small embarrassment to the Jesuit missionaries, to whom they produced so many miracles, wrought by their saints, in proof of their religion, and those so well circumstantiated and attested, that the Jesuits were obliged to deny miracles to be any evidence of a true religion; and in proof hereof, to allege the same arguments against the Abyssinians which Protestants in Europe allege against Papists. They pray for the dead, and invoke saints and angels; have so great a veneration for the virgin, that they charged the Jesuits with not rendering her honour enough. They venerate images in painting; but abhor all those in relievo, except the cross. They hold that the soul of man is not created; because, say they, God finished all his works on the sixth day. They admit the apocryphal books, and the canons of the apostles, as well as the apostolical constitutions, for genuine. Their liturgy is given by Alvarez, and in English by Pagit; and their calendar by Ludolph.

ACA, ACE, or ACON, in *Ancient Geography*, a town of Phœnicia, on the Mediterranean; afterwards called *Ptolemais*; now *Acre*. See *ACRE*.

ACACALOTL, the Brasilian name of a bird called by some *corvus aquaticus*, or the water raven: properly, the pelicanus carbo, or corvorant. See *ORNITHOLOGY Index*.

ACACIA, EGYPTIAN THORN, or BINDING BEAN-TREE, in *Botany*, a species of mimosa, according to Linnæus; though other botanists make it a distinct genus. See *MIMOSA*, *BOTANY Index*.

The flowers of a species of the acacia are used by the Chinese in making that yellow which we see bears washing in their silks and stuffs, and appears with so much elegance in their painting on paper. The method is this:

They gather the flowers before they are fully open; these they put in a clean earthen vessel over a gentle heat, and stir them continually about as they do the tea leaves, till they become dryish and of a yellow colour; then to half a pound of the flowers they add three spoonfuls of fair water, and after that a little more, till there is just enough to hold the flowers incorporated together; they boil this for some time, and the juice of the flowers mixing with the water, it becomes thick and yellow; they then take it from the fire, and strain it through a piece of coarse silk. To the liquor they add half an ounce of common alum, and an ounce of calcined oyster shells reduced to a fine powder. All is then well mixed together; and this is the fine lasting yellow they have so long used.

The dyers of large pieces use the flowers and seeds of the acacia for dyeing three different sorts of yellow. They roast the flowers, as before observed; and then mix the seeds with them, which must be gathered for this purpose when full ripe: by different admixture of these, they give the different shades of colour, only for the deepest of all they add a small quantity of Brasil wood.

Mr Geoffroy attributes the origin of bezoar to the seeds of this plant; which being browsed by certain animals, and vellicating the stomach by their great sourness and astringency, cause a condensation of the juices, till at length they become coated over with a stony matter, which we call *BEZOAR*.

Acacia

Acacius.

False ACACIA. See ROBINIA, BOTANY Index.
Three-thorned ACACIA, or Honey-locust. See GLEDITSIA, BOTANY Index.

ACACIA, in the *Materia Medica*, the inspissated juice of the unripe fruit of the *MIMOSA Nilotica*.

The juice is brought to us from Egypt, in roundish masses wrap up in thin bladders. It is outwardly of a deep brown colour, inclining to black; inwardly of a reddish or yellowish brown; of a firm consistence, but not very dry. It soon softens in the mouth, and discovers a rough, not disagreeable taste, which is followed by a sweetish relish. This inspissated juice entirely dissolves in watery liquors; but is scarce sensibly acted on by rectified spirit.

Acacia is a mild astringent medicine. The Egyptians give it in spitting of blood, in the quantity of a drachm, dissolved in any convenient liquor; and repeat this dose occasionally: they likewise employ it in collyria for strengthening the eyes, and in gargarisms for quinsys. Among us, it is little otherwise used than as an ingredient in mithridate and theriaca, and is rarely met with in the shops. What is usually sold for the Egyptian acacia, is the inspissated juice of unripe sloes; this is harder, heavier, of a darker colour, and somewhat sharper taste, than the true sort. See the next article.

German ACACIA, the juice of unripe sloes inspissated nearly to dryness over a gentle fire, care being taken to prevent its burning. It is moderately astringent, similar to the Egyptian acacia, for which it has been commonly substituted in the shops. It is given in fluxes, and other disorders where styptic medicines are indicated, from a scruple to a drachm.

ACACIA, among antiquaries, something resembling a roll or bag, seen on medals, as in the hands of several consuls and emperors. Some take it to represent a handkerchief rolled up, wherewith they made signals at the games; others a roll of petitions or memorials; and some, a purple bag full of earth, to remind them of their mortality.

ACACIANS, in ecclesiastical history, the name of several sects of heretics; some of which maintained, that the Son was only a similar, not the same, substance with the Father; and others, that he was not only a distinct but a dissimilar substance. Two of these sects had their denominations from Acacius bishop of Caesarea, who lived in the fourth century, and changed his opinions, so as, at different times, to be head of both. Another was named from Acacius patriarch of Constantinople, who lived in the close of the fifth century.

ACACIUS, surnamed LUSCUS, because he was blind of one eye, was bishop of Caesarea in Palestine, and succeeded the famous Eusebius: he had a great share in the banishment of Pope Liberius, and bringing Felix to the see of Rome. He gave name to a sect, and died about the year 365. He wrote the life of Eusebius, which is lost, and several other works.

ACACIUS, *Saint*, bishop of Amida in Mesopotamia, in 420, was distinguished by his piety and charity. He sold the plate belonging to his church, to redeem seven thousand Persian slaves who were perishing with hunger. He gave each of them some money and sent them home. Veranius their king was so affected with this noble instance of benevolence, that he desired to see the bishop;

and this interview procured a peace between that prince and Theodosius I.

There have been several other eminent persons of the same name; particularly, a martyr under the emperor Decius: a patriarch of Antioch, who succeeded Basil in 458, and died in 459: a bishop of Miletum in the fifth century: a famous rhetorician in the reign of the emperor Julian: and, a patriarch of Constantinople in the fifth century; who was ambitious to draw the whole power and authority of Rome by degrees to Constantinople, for which he was excommunicated by Pope Felix II. He in his turn passed sentence of excommunication against the pope. Still, however, he held his patriarchate till his death in 488.

ACAD, or ACHAD, in *Ancient Geography*, the town in which Nimrod reigned, called *Archad* by the Seventy; situated in Babylonia, to the eastward of the Tigris.

ACADEMICIAN, or ACADEMIST, a member of an academy. See ACADEMY in the modern sense.

ACADEMICS, or ACADEMISTS, a denomination given to the cultivators of a species of philosophy originally derived from Socrates, and afterwards illustrated and enforced by Plato, who taught in a grove near Athens, consecrated to the memory of Academus, an Athenian hero; from which circumstance this philosophy received the name of *Academical*. Before the days of Plato, philosophy had in a great measure fallen into contempt. The contradictory systems and hypotheses which had successively been urged upon the world were become so numerous, that, from a view of this inconstancy and uncertainty of human opinions, many were led to conclude, that truth lay beyond the reach of our comprehension. Absolute and universal scepticism was the natural consequence of this conclusion. In order to remedy this abuse of philosophy and of the human faculties, Plato laid hold of the principles of the academical philosophy; and, in his *Phædo*, reasons in the following manner: "If we are unable to discover truth (says he), it must be owing to two circumstances: either there is no truth in the nature of things; or the mind, from a defect in its powers, is not able to apprehend it. Upon the latter supposition, all the uncertainty and fluctuation in the opinions and judgments of mankind admit of an easy solution: Let us therefore be modest, and ascribe our errors to the real weakness of our own minds, and not to the nature of things themselves. Truth is often difficult of access: in order to come at it, we must proceed with caution and diffidence, carefully examining every step; and, after all our labour, we will frequently find our greatest efforts disappointed, and be obliged to confess our ignorance and weakness."

Labour and caution in their researches, in opposition to rash and hasty decisions, were the distinguishing characteristics of the disciples of the ancient academy. A philosopher, possessed of these principles, will be slow in his progress; but will seldom fall into errors, or have occasion to alter his opinion after it is once formed. Vanity and precipitance are the great sources of scepticism: hurried on by these, instead of attending to the cool and deliberate principles recommended by the academy, several of our modern philosophers have plunged themselves into an absurd and ridiculous kind of scepticism. They pretend to discredit subjects that

are

Acacius

Academic.

Academies, are plain, simple, and easily comprehended; but give Academy. peremptory and decisive judgments upon things that evidently exceed the limits of our capacity. Of these, Berkeley and Hume are the most considerable. Berkeley denied the existence of every thing, excepting his own ideas. Mr Hume has gone a step further, and questioned even the existence of ideas; but at the same time has not hesitated to give determined opinions with regard to eternity, providence, and a future state, miraculous interpositions of the Deity, &c. subjects far above the reach of our faculties. In his essay on the academical or sceptical philosophy, he has confounded two very opposite species of philosophy. After the days of Plato, indeed, the principles of the first academy were grossly corrupted by Arcesilas, Carneades, &c. This might lead Mr Hume into the notion that the academical and sceptical philosophy were synonymous terms. But no principles can be of a more opposite nature than those which were inculcated by the old academy of Socrates and Plato, and the sceptical notions which were propagated by Arcesilas, Carneades, and the other disciples of the succeeding academies.

ACADEMY, in antiquity, a garden, villa, or grove, situated within a mile of Athens, where Plato and his followers held their philosophical conferences. It took its name from one Academus, or Ecademus, who was the original owner of it, and made it a kind of gymnasium. He lived in the time of Theseus; and, after his death, it retained his name, and was consecrated to his memory. Cimon embellished it with fountains, trees, and walks; but Sylla, during the siege of Athens, employed these very trees in making battering engines against the city. Cicero too had his villa, or place of retirement, near Puzzuoli, which he also named an *academy*, where he composed his *Academical Questions*, and his book *De Natura Deorum*.

ACADEMY, among the moderns, is most commonly used to signify a SOCIETY of learned men, established for the improvement of any art or science, and generally under the protection of a prince. Ptolemy Soter, for the encouragement and improvement of the liberal arts in his dominions, founded an academy at Alexandria, and provided it with a collection of books, which was the foundation of the Alexandrian library.

Theodosius the younger established an academy at Constantinople, and appointed professors of every science, with the view of making it a rival institution to that at Rome; which, with the other literary seminaries, had been destroyed by the Goths about the end of the fourth and the beginning of the fifth centuries.

The first academy we read of was established by Charlemagne, at the instigation of ALCUIN. It was composed of the chief wits of the court, the emperor himself being a member. In their academical conferences, every person was to give an account of what ancient authors he had read: and each even assumed the name of some ancient author who pleased him most, or some celebrated person of antiquity. Alcuin, from whose letters we learn those particulars, took that of Flaccus, the surname of Horace: a young lord, named Augilbert, took that of Homer: Adelard, bishop of Corbie, was called Augustine: Riculfe, bishop of Mentz, was Dametas; and the king himself, David.

This shows the mistake of some modern writers, who relate, that it was in conformity with the genius of the learned men of those times, who were great admirers of Roman names, that Alcuin took the name of Flaccus Albinus.

Most nations have now their academies; but Italy has the greatest number. Many flourishing academies existed in France before the revolution. Most of them were established by Louis XIV. We have but few in Britain; and those of chiefest note go by a different name, viz. SOCIETY.

In giving an account of the principal academies, it seems most proper to arrange them according to their subjects.

I. *MEDICAL Academies*, as that of the *Naturæ Curiosos* in Germany; that founded at Palermo in 1645; another at Venice in 1701, which meets weekly in a hall near the grand hospital; another at Geneva in 1715, in the house of M. le Clerc. The colleges of physicians at London and Edinburgh, are also, by some, ranked in the number of *academies*.

The *Academy of Naturæ Curiosos*, called also the *Leopoldine Academy*, was founded in 1652 by Jo. Laur. Bauschius, a physician; who, in imitation of the English, published an invitation to all physicians to communicate their extraordinary cases; and, meeting with success, was elected president. Their works were at first published separately; but in 1670 a new scheme was laid for publishing a volume of observations every year. The first volume appeared in 1684, under the title of *Ephemerides*, and the work has been continued with some interruptions and variations of the title, &c. In 1687, the emperor Leopold took the society under his protection, granting the members several privileges, particularly that their presidents should be counts palatine of the holy Roman empire. This academy has no fixed residence, or regular assemblies: instead of these, there is a kind of bureau, or office, first established at Breslau, and afterwards removed to Nuremberg, where letters, observations, &c. from correspondents or members are taken in. The academy consists of a president, two adjuncts or secretaries, and colleagues or members without restriction. The colleagues, at their admission, oblige themselves to two things; first, to chuse some subject out of the animal, vegetable, or mineral kingdom, for discussion, provided it had not been treated of by any colleague before; the second, to apply themselves to furnish materials for the Annual *Ephemerides*. Each member to bear a symbol of the academy; viz. a gold ring; whereon, instead of a stone, is a book open, and, on the face thereof, an eye; on the other side, the motto of the academy, *Nunquam otiosus*.

II. *CHIRURGICAL Academies*; as that instituted some years ago, by public authority, at Paris: the members of which were not only to publish their own and correspondents observations and improvements; but to give an account of all that is published on surgery, and to compose a complete history of the art, by their extracts from all the authors ancient and modern who have wrote on it. A question in surgery was annually proposed by the academy, and a gold medal of 200 livres value was given to the successful competitor.

Academy of Surgery at Vienna, was instituted some years ago by the present emperor, under the direction of

Academy.

Academies of the celebrated Brambilla. In this there were at first only two professors; and to their charge the instruction of 130 young men was committed, 30 of whom had formerly been surgeons in the army. But of late the number both of the teachers and pupils has been considerably increased. Gabrieli has been appointed to teach pathology and practice; Boecking, anatomy, physiology, and physics; Streit, medical and pharmaceutical surgery; Hunczowsky, surgical operations, midwifery, and the *chirurgia forensis*; and Plenk, chemistry and botany. To these also has been added, Beindel as prosector and extraordinary professor of surgery and anatomy. Besides this, the emperor, with his usual liberality, has provided a large and splendid edifice in Vienna, which affords habitation both for the teachers, the students, pregnant women, patients for clinical lectures, and servants. He has also purchased for the use of this academy a medical library, which is open every day; a complete set of surgical instruments; an apparatus for experiments in natural philosophy; a collection of natural history; a number of anatomical and pathological preparations; a collection of preparations in wax brought from Florence; and a variety of other useful articles. Adjoining to the building also there is a good botanical garden.

Among other parts of this institution, three prize medals, each of the value of 40 florins, are to be annually bestowed on those students who return the best answer to questions proposed the year before. These prizes are not entirely founded by the emperor, but are in part owing to the liberality of Brendelius, the proto-chirurgus at Vienna.

III. *ECCLESIASTICAL Academies*; as that at Bologna in Italy, instituted in 1687, employed in the examination of the doctrine, discipline, and history, of each age of the church.

IV. *COSMOGRAPHICAL Academies*; as that at Venice, called the *Argonauts*. This was instituted at the solicitation of F. Coronelli, for the improvement of geographical knowledge. Its design was to publish exact maps, both celestial and terrestrial, as well particular as general, together with geographical, historical, and astronomical descriptions. Each member, in order to defray the expence of such a publication, was to subscribe a proportional sum, for which they were to receive one or more copies of each piece published. For this end three societies are settled; one under F. Moro, provincial of the Minorites in Hungary; another under the Abbot Laurence au Ruy Payenne au Marais; the third under F. Baldigiani, Jesuit professor of mathematics in the Roman college. The device of this academy is the terraqueous globe, with the motto *Plus ultra*; and at its expence all the globes, maps, and geographical writings of F. Coronelli have been published.

V. *Academies of SCIENCES*.—These comprehend such as are erected for improving natural and mathematical knowledge. They are otherwise called *Philosophical* and *Physical Academies*.

The first of these was instituted at Naples, about the year 1560, in the house of Baptista Porta. It was called the *Academy Secretorum Naturæ*; and was succeeded by the Academy of *Lyncei*, founded at Rome by Prince Frederic Cesi, towards the end of that century. Several of the members of this academy rendered it fa-

mous by their discoveries; among these was the celebrated Galileo. Several other academies were instituted about that time, which contributed greatly to the advancement of the sciences; but none of them comparable to that of the *Lyncei*.

Some years after the death of Torricelli, the *Academy del Cimento* made its appearance, under the protection of Prince Leopold, afterwards Cardinal de Medicis. Redi was one of its chief members: and the studies pursued by the rest may be collected from those curious experiments published in 1667, by their secretary Count Laurence Magulotti, under the title of *Saggi di Naturali Esperienze*; a copy of which was presented to the Royal Society, translated into English by Mr Waller, and published at London in 4to.

The *Academy degli Inquieti*, afterwards incorporated into that of Della Tracia in the same city, followed the example of that of Del Cimento. Some excellent discourses on physical and mathematical subjects, by Geminiano Montenari, one of the chief members, were published in 1667, under the title of *Pensieri Fisico-Matematici*.

The *Academy of Rossano*, in the kingdom of Naples, was originally an academy of belles lettres, founded in 1540, and transformed into an academy of sciences in 1695, at the solicitation of the learned abbot Don Giacinto Gimma; who being made president, under the title of Promoter General thereof, gave them a new set of regulations. He divided the academists into the following classes: Grammarians, Rhetoricians, Poets, Historians, Philosophers, Physicians, Mathematicians, Lawyers, and Divines, with a class apart for cardinals and persons of quality. To be admitted a member, a man must have some degrees in the faculty. The members are not allowed to take the title of *Academists* in the beginning of their books, without a written permission from their president, which is not granted till the work has been examined by the censors of the academy; and the permission is the greatest honour the academy can confer, as they thereby adopt the work, and are answerable for it against all criticisms that may be made upon it. To this law the president or promoter himself is subject; and no academist is allowed to publish any thing against the writings of another without leave from the society.

Several other academies of *Sciences* have been founded in Italy; but, for want of being supported by princes, did not continue long. The loss of them, however, was abundantly repaired by the institution of others still subsisting: such as, the *Academy of Filarmenici* at Verona; of *Ricovatri* at Padua, where a learned discourse on the origin of springs was delivered by Sig. Vallisnieri, first professor of physie in the university of that city, and which was afterwards printed. To the Academy of the *Muti de Reggio*, at Modena, the same Sig. Vallisnieri presented an excellent discourse on the scale of created beings, since inserted in his history of the generation of man and animals, printed at Venice in the year 1721.

F. Marsenne is said to have given the first idea of a philosophical academy in France, towards the beginning of the 17th century, by the conferences of naturalists and mathematicians occasionally held at his lodgings; at which Gassendi, Des Cartes, Hobbes, Roberval, Pascal, Blondel, and others assisted. F. Mer-

senne

academies. science proposed to each certain problems to examine, or certain experiments to be made. These private assemblies were succeeded by more public ones, formed by Mr Montmort, and Mr Thevenot the celebrated traveller. The French example animated several Englishmen of distinction and learning to erect a kind of philosophical academy at Oxford, towards the close of Oliver Cromwell's administration; which, after the Restoration, was erected into a Royal Society. See SOCIETY. The English example, in its turn, animated the French. Louis XIV. in 1666, assisted by the counsels of M. Colbert, founded an academy of sciences at Paris, with a sufficient revenue to defray the charge of experiments, and salaries to the members.

Royal Society of Sciences. After the peace of the Pyrenees, Louis XIV. being desirous of establishing the arts, sciences, and literature, upon a solid foundation, directed M. Colbert to form a society of men of known abilities and experience in the different branches, who should meet together under the king's protection, and communicate their respective discoveries. Accordingly M. Colbert, having conferred with those who were at that time most celebrated for their learning, resolved to form a society of such persons as were conversant in natural philosophy and mathematics, to join to them other persons skilled in history and other branches of erudition, along with those who were entirely engaged in what are called the *Belles Lettres*, grammar, eloquence, and poetry. The geometricians and natural philosophers were ordered to meet on Tuesdays and Saturdays, in a great hall of the king's library, where the books of mathematics and natural philosophy were contained; the learned in history to assemble on Mondays and Thursdays, in the hall where the books of history were contained; and the class of belles lettres to assemble on Wednesdays and Fridays. All the different classes were likewise ordered to meet together upon the first Thursday of every month; and, by their respective secretaries, make a report of the proceedings of the foregoing month.

In a short time, however, the classes of history, belles lettres, &c. were united to the *French Academy*, which was originally instituted for the improvement and refining the French language: so that the Royal Academy contained only two classes, viz. that of natural philosophy and mathematics.

In the 1696, the king, by proclamation dated the 26th of January, gave this academy a new form, and put it upon a more respectable footing. It was now to be composed of four kinds of members, viz. *honorary, pensionary, associates and élèves*. These last were a kind of pupils, or scholars, one of whom was attached to each of the pensionaries. The first class to contain ten persons, and each of the rest twenty. The honorary academists to be all inhabitants of France; the pensionaries all to reside at Paris: eight of the associates allowed to be foreigners; and the élèves all to live at Paris. The officers to be, a president named by the king, out of the class of honorary academists; and a secretary and treasurer to be perpetual. Of the pensionaries, three to be geometricians, three astronomers, three mechanics, three anatomists, three chemists, three botanists, and the remaining two to be secretary and treasurer. Of the twelve associates, two to apply themselves to geometry, two to botany, and

two to chemistry. The élèves to apply themselves to the same kind of science with the pensionaries they were attached to; and not to speak, except when called by the president. No regular or religious to be admitted, except into the class of honorary academists; nor any person to be admitted either for associate or pensionary, unless known by some considerable printed work, some machine, or other discovery. The assemblies were held on Wednesdays and Saturdays, unless either of them happened to be a holiday, and then the assembly was held on the preceding day. To encourage the members to pursue their labours, the king engaged not only to pay the ordinary pensions, but even to give extraordinary gratifications according to the merit of their respective performances; furnishing withal the expence of the experiments and other inquiries necessary to be made. If any member gave in a bill of charges of experiments he had made, or desired the printing of any book, and brought in the charges of gravings, the money was immediately paid by the king, upon the president's allowing and signing the bill. So if an anatomist required live tortoises, for instance, for making experiments about the heart, &c. as many as he pleased were brought him at the king's charge. Their motto was *Invenit et perfecit*.

In the year 1716, the duke of Orleans, then regent, made an alteration in their constitution; augmenting the number of honoraries, and of associates capable of being foreigners, to 12; admitting regulars among such associates; and suppressing the class of élèves, as it appeared to be attended with some inconveniences, particularly that of making too great an inequality among the academists, and being productive of some misunderstandings and animosities among the members.

At the same time he created other two classes; one consisting of 12 adjuncts, who, as well as the associates, were allowed a deliberative voice in matters relative to science; and the other six free associates, who were not attached to any particular science, nor obliged to pursue any particular work.

Since its re-establishment in 1669, this academy has been very exact in publishing, every year, a volume containing either the works of its own members, or such memoirs as have been composed and read to the academy during the course of that year. To each volume is prefixed the history of the academy, or an extract of the memoirs, and, in general, of whatever has been read or said in the academy; at the end of the history, are the eulogiums upon such academists as have died that year. M. Rouille de Meslay, counsellor to the parliament of Paris, founded two prizes, one of 2500, and the other of 2000 livres, which were alternately distributed by the parliament every year: the subject for the first must relate to physical astronomy, and those for the latter to navigation and commerce.

Notwithstanding the advantages which the members of this academy enjoyed over others, in having their expences defrayed, and even being paid for their time and attendance, they had fallen under some imputations, particularly that of plagiarism, or borrowing their neighbours inventions; but with what justice we do not say. This academy was suppressed and abolished by the convention in 1793; and other institutions have been established. See INSTITUTE.

The French had also considerable academies in most of

Academies.

of their great cities: as, at Montpellier a royal academy of sciences on the like footing as that of Paris, being as it were a counterpart thereof; at Thoulouse, an academy under the denomination of Lanternists; others at Nismes, Arles, Lyons, Dijon, Bourdeaux, &c.

The Royal Academy of Sciences at Berlin was founded in 1700, by Frederic II. king of Prussia, on the model of that of England; excepting that, besides natural knowledge, it likewise comprehends the belles lettres. In 1710, it was ordained that the president shall be one of the counsellors of state, and nominated by the king. The members were divided into four classes; the first for prosecuting physics, medicine, and chemistry; the second for mathematics, astronomy, and mechanics; the third for the German language and the history of the country; the fourth for oriental learning, particularly as it may concern the propagation of the Gospel among infidels. Each class to elect a director for themselves, who shall hold his post for life. The members of any of the classes have free admission into the assemblies of any of the rest.

The great promoter of this institution was the celebrated Mr Leibnitz, who accordingly was made the first director. The first volume of their transactions was published in 1710, under the title of *Miscellanea Berolinensia*; and though they received but few marks of the royal favour for some time, they continued to publish new volumes in 1723, 1727, 1734, and 1740. At last, however, Frederic III. the late king of Prussia, gave new vigour to this academy, by inviting to Berlin such foreigners as were most distinguished for their merit in literature, and encouraged his subjects to prosecute the study and cultivation of the sciences by giving ample rewards; and thinking that the academy, which till that time had had some minister or opulent nobleman for its president, would find an advantage in having a man of letters at its head, he conferred that honour on M. Maupertuis. At the same time he gave a new regulation to the academy, and took upon himself the title of its protector.

The academists hold two public assemblies annually; one in January, on the late king's birth day; and the other in May, on the day of his accession to the throne. At the latter of these is given, as a prize, a gold medal of 50 ducats value: the subject for this prize is successively natural philosophy, mathematics, metaphysics, and erudition.

The Imperial Academy of Sciences at Petersburg was projected by Czar Peter the Great. That great monarch having, during his travels, observed the advantage of public societies for the encouragement and promotion of literature, formed the design of founding an academy of sciences at St Petersburg. By the advice of Wolf and Leibnitz, whom he consulted on this occasion, the society was regulated, and several learned foreigners were invited to become members. Peter himself drew the plan, and signed it on the 10th of February 1724; but was prevented, by the suddenness of his death, from carrying it into execution. His decease, however, did not prevent its completion: for on the 21st of December 1725, Catharine I. established it according to Peter's plan; and on the 27th of the same month the society was first assembled. On the 1st of August 1726, Catharine honoured the meeting

with her presence, when Professor Bulfinger, a German naturalist of great eminence, pronounced an oration upon the advances made by the loadstone and needle for the discovery of the longitude.

The empress settled a fund of 4982l. *per annum* for the support of the academy; and fifteen members all eminent for their learning and talents, were admitted and pensioned, under the title of Professors in the various branches of literature and science. The most distinguished of these professors were Nicholas and Daniel Bernoulli, the two De Lises, Bulfinger, and Wolf.

During the short reign of Peter II. the salaries of the members were discontinued, and the academy was utterly neglected by the court; but it was again patronised by the empress Anne, who even added a seminary for the education of youth, under the superintendence of the professors. Both institutions flourished for some time under the direction of Baron Korf; but upon his death, towards the latter end of Anne's reign, an ignorant person being appointed president, many of the most able members quitted Russia. At the accession of Elizabeth, new life and vigour were again restored to the academy: the original plan was enlarged and improved; some of the most learned foreigners were again drawn to Petersburg; and, what was considered as a good omen for the literature of Russia, two natives, Lomonosof and Rumovsky, men of genius and abilities, who had prosecuted their studies in foreign universities, were enrolled among its members. The annual income was increased to 10,659l. and soon afterwards the new institution took place.

The late empress Catharine II. with her usual zeal for promoting the diffusion of knowledge, took this useful society under her more immediate protection. She altered the court of directors greatly to the advantage of the whole body; corrected many of its abuses, and infused a new vigour and spirit into their researches. By her majesty's particular recommendation the most ingenious professors visited the various provinces of her vast dominions; and as the fund of the academy was not sufficient to supply the whole expence of these several expeditions, the empress bestowed a largess of 2000l. which she renewed as occasion required.

The purpose and intent of these travels will appear from the instructions given by the academy to the several persons who were engaged in them. They were ordered to pursue their inquiries upon the different sorts of earths and waters; upon the best methods of cultivating the barren and desert spots; upon the local disorders incident to men and animals, and the most efficacious means of relieving them; upon the breeding of cattle, and particularly of sheep; on the rearing of bees and silk worms; on the different places and objects for fishing and hunting; on minerals; on the arts and trades, and on forming a *Flora Russica*, or collection of indigenous plants; they were particularly instructed to rectify the longitude and latitude of the principal towns; to make astronomical, geographical, and meteorological observations; to trace the course of the rivers; to take the most exact charts; and to be very distinct and accurate in remarking and describing the manners and customs of the different people, their dresses, languages, antiquities, traditions, history, religion;

Academies.

Academies. gion; and, in a word, to gain every information which might tend to illustrate the real state of the whole Russian empire.

In consequence of these expeditions, perhaps no country can boast, within the space of so few years, such a number of excellent publications on its internal state, on its natural productions, on its topography, geography, and history, on the manners, customs, and languages of the different people, as have issued from the press of this academy.

The first transactions of this society were published in 1728, and entitled *Commentarii Academiæ Scientiarum Imperialis Petropolitane ad ann. 1726*, with a dedication to Peter II. The publication was continued under this form until the year 1747, when its transactions were called *Novi Commentarii Academiæ*, &c. In 1777 the academy again changed the title into *Acta Academiæ Scientiarum Imperialis Petropolitane*, and likewise made some alteration in the arrangement and plan of the work. The papers, which had been hitherto published in the Latin tongue, are now written either in that language or French; and a preface is added, styled *Partie Historique*, which contains an account of its proceedings, meetings, admission of new members, and other remarkable occurrences. Of the Commentaries, 14 volumes were published: the first of the New Commentaries made its appearance in 1750, and the twentieth in 1776. Under the new title of *Acta Academiæ*, several volumes have been given to the public, and two are printed every year. These transactions abound with ingenious and elaborate disquisitions upon various parts of science and natural history, and which reflect the greatest honour upon their authors; and it may not be an exaggeration to assert, that no society in Europe has more distinguished itself for the excellence of its publications, and particularly in the more abstruse parts of the pure and mixed mathematics.

The academy is still composed, as at first, of fifteen professors, besides the president and director. Each of these professors has a house and an annual stipend from 200l. to 600l. Beside the professors, there are four adjuncts, who are pensioned, and who are present at the sittings of the society, and succeed to the first vacancies. The direction of the academy is at present consigned to the princess Dashkof.

The building and apparatus of this academy are extraordinary. There is a fine library, consisting of 36,000 curious books and manuscripts. There is an extensive museum, in which the various branches of natural history, &c. are distributed in different apartments: it is extremely rich in native productions, having been considerably augmented with a variety of specimens collected by Pallas, Gmelin, Guldenstaedt, and other learned professors, during their late expeditions through the Russian empire. The stuffed animals and birds occupy one apartment. The chamber of rarities, the cabinet of coins, &c. contain innumerable articles of the highest curiosity and value. The society has this modest motto, *Paulatim*.

The Academy of Sciences at Bologna, called the *Institute of Bologna*, was founded by Count Marsigli in 1712, for the cultivating of physics, mathematics, medicine, chemistry, and natural history. Its history is written by

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M. de Limiers, from memoirs furnished by the founder Academies. himself.

The Academy of Sciences at Stockholm, or Royal Swedish Academy, owes its institution to six persons of distinguished learning, amongst whom was the celebrated Linnæus: they originally met on the 2d of June 1739; formed a private society, in which some dissertations were read; and in the latter end of the same year their first publication made its appearance. As the meetings continued and the members increased, the society attracted the notice of the king, and was, on the 31st of March 1741, incorporated under the name of the Royal Swedish Academy. Not receiving any pension from the crown, it is only under the protection of the king, being directed, like our Royal Society, by its own members. It has now a large fund, which has chiefly arisen from legacies and other donations; but a professor of experimental philosophy, and two secretaries, are still the only persons who receive any salaries. Each of the members resident at Stockholm becomes president by rotation, and continues in office during three months. There are two species of members, native and foreign: the election of the former is held in April, and of the latter in July: no money is paid at the time of admission. The dissertations read at each meeting are collected and published four times in the year; they are written in the Swedish language, and printed in octavo; and the annual publications make a volume. The first 40 volumes, which were finished in 1779, are called the Old Transactions; for in the following year the title was changed into that of New Transactions. The king is sometimes present at the ordinary meetings, and particularly at the annual assembly in April for the election of members. Any person who sends a treatise which is thought worthy of being printed, receives the Transactions for that quarter *gratis*, and a silver medal, which is not esteemed for its value, being worth only three shillings, but for its rarity and the honour conveyed by it. All the papers relating to agriculture are published separately under the title of *Oeconomica Acta*. Annual premiums, in money and gold medals, principally for the encouragement of agriculture and inland trade, are also distributed by the academy. The fund for these prizes is supplied from private donations.

The Royal Academy of Sciences at Copenhagen owes its institution to the zeal of six literati, whom Christian VI. in 1742, ordered to arrange his cabinet of medals. The count of Holstein was the first president; and the six persons who first formed the design, were John Gram, Joachim Frederic Ramus, Christian Louis Scheid, Mark Woldickey, Eric Pontopidan, and Bernard Moelman. These persons occasionally meeting for that purpose, extended their designs; associated with them others who were eminent in several branches of science; and forming a kind of literary society, employed themselves in searching into and explaining the history and antiquities of their country. The count of Holstein warmly patronised this society, and recommended it so strongly to Christian VI. that, in 1743, his Danish majesty took it under his protection, called it the Royal Academy of Sciences, endowed it with a fund, and ordered the members to join to their former pursuits, natural history, physics, and mathematics.

Academies. matics. In consequence of the royal favour, the members engaged with fresh zeal in their pursuits; and the academy has published 15 volumes in the Danish language, some of which have been translated into Latin.

The *American Academy of Sciences* was established in 1780, by the council and house of representatives in the province of Massachusetts's Bay, for promoting the knowledge of the antiquities of America, and of the natural history of the country; for determining the uses to which its various natural productions might be applied; for encouraging medicinal discoveries, mathematical disquisitions, philosophical inquiries and experiments, astronomical, meteorological, and geographical observations, and improvements in agriculture, manufactures, and commerce; and, in short, for cultivating every art and science which may tend to advance the interest, honour, dignity, and happiness of a free, independent, and virtuous people. The members of this academy are never to be more than 200, nor less than 40.

Royal Irish Academy arose out of a society established at Dublin, about the year 1782, and consisting of a number of gentlemen, most of whom belonged to the university. They held weekly meetings, and alternately read essays on various subjects. The members of this society afterwards formed a more extensive plan, and admitting only such names as might add dignity to their new institution, became the founders of the *Royal Irish Academy*, which professes to unite the advancement of science with the history of mankind and polite literature. The first volume of their transactions for 1787 appeared in 1788, and seven volumes have been since published. A society was formed in Dublin, similar to the Royal Society in London, as early as the year 1683; but the distracted state of the country was unpropitious to the cultivation of philosophy and literature. The plan was resumed about the beginning of the present century, and the earl of Pembroke, then lord lieutenant, was president of a philosophical society established in Dublin college. In the year 1740, there was instituted a Physico-historical Society; of which two volumes of minutes are extant: but this society soon declined.

VI. *Academies or Schools of Arts*; as that at Petersburg, which was established by the empress Elizabeth, at the suggestion of Count Shuvalof, and annexed to the Academy of Sciences: the fund was 4000l. per annum, and the foundation for 40 scholars. The late empress formed it into a separate institution, enlarged the annual revenue to 12,000l. and augmented the number of scholars to 300; she also constructed, for the use and accommodation of the members, a large circular building, which fronts the Neva. The scholars are admitted at the age of six, and continue until they have attained that of 18: they are clothed, fed, and lodged, at the expence of the crown. They are all instructed in reading and writing, arithmetic, the French and German languages, and drawing. At the age of 14 they are at liberty to choose any of the following arts, divided into four classes: 1. Painting in all its branches, of history, portraits, battles, and landscapes; architecture; mosaic; enamelling, &c. 2. Engraving on copperplates, seal-cutting, &c. 3. Carving on wood, ivory, and amber. 4. Watch-making, turn-

ing, instrument-making, casting statues in bronze and other metals, imitating gems and medals in paste and other compositions, gilding, and varnishing. Prizes are annually distributed to those who excel in any particular art; and from those who have obtained four prizes, twelve are selected, who are sent abroad at the charge of the empress. A certain sum is paid to defray their travelling expences; and when they are settled in any town, they receive an annual salary of 60l. which is continued during four years. There is a small assortment of paintings for the use of the scholars; and those who have made great progress are permitted to copy the pictures in the empress's collection. For the purpose of design, there are models in plaster of the best antique statues in Italy, all done at Rome, of the same size with the originals, which the artists of the academy were employed to cast in bronze.

The *Royal Academy of Arts in London*, was instituted for the encouragement of *Designing, Painting, Sculpture, &c. &c.* in the year 1768. This academy is under the immediate patronage of the king, and under the direction of 40 artists of the first rank in their several professions. It furnishes, in winter, living models of different characters to draw after; and in summer, models of the same kind to paint after. Nine of the ablest academicians are annually elected out of the 40, whose business is to attend by rotation, to set the figures, to examine the performance of the students, and to give them necessary instructions. There are likewise four professors, of *Painting, of Architecture, of Anatomy, and of Perspective*, who annually read public lectures on the subjects of their several departments; beside a president, a council, and other officers. The admission to this academy is free to all students properly qualified to reap advantage from the studies cultivated in it; and there is an annual exhibition of paintings, sculptures, and designs, open to all artists of distinguished merit.

The *Academy of Painting and Sculpture at Paris*. This took its rise from the disputes that happened between the master painters and sculptors in that capital; in consequence of which, M. le Brun, Sarazin, Corneille, and others of the king's painters, formed a design of instituting a particular academy; and, having presented a petition to the king, obtained an arrêt dated January 20. 1648. In the beginning of 1655, they obtained from Cardinal Mazarine a brevet, and letters patent, which were registered in parliament; in gratitude for which favour, they chose the cardinal for their protector, and the chancellor for their vice-protector. In 1663, by means of M. Colbert, they obtained a pension of 4000 livres. The academy consisted of a protector; a vice protector; a director; a chancellor; four rectors; adjuncts to the rectors; a treasurer; four professors, one of which was professor of anatomy, and another of geometry; several adjuncts and counsellors, a historiographer, a secretary, and two ushers.

The Academy of Painting held a public assembly every day for two hours in the afternoon, to which the painters resorted either to design or to paint, and where the sculptors modelled after a naked person. There were 12 professors, each of whom kept the school for a month: and there were 12 adjuncts to supply them in case of need. The professor upon duty placed the naked man

academies. as he thought proper, and set him in two different attitudes every week. This was what they called *setting the model*. In one week of the month he set two models together, which was called *setting the group*. The paintings, and models made after this model, were called *academies*, or *academy figures*. They had likewise a woman who stood for a model in the public school. Every three months, three prizes for design were distributed among the *elevés* or disciples; two others for painting, and two for sculpture, every year.

There was also an Academy of Painting, Sculpture, &c. at Rome, established by Lewis XIV. wherein those who had gained the annual prize at Paris were entitled to be three years entertained at the king's expence, for their further improvement.

Musical Academy, consists of the managers and directors of the opera.

The *Academy of Ancient Music* was established in London in 1710, by several persons of distinction, and other gentlemen, in conjunction with the most eminent masters of the time, with a view to the study and practice of vocal and instrumental harmony. This institution, which had the advantage of a library, consisting of the most celebrated compositions both foreign and domestic, in manuscript and in print, and which was aided by the performances of the gentlemen of the chapel royal, and the choir of St Paul's, with the boys belonging to each, continued to flourish for many years. In 1731, a charge of plagiarism brought against Bononcini, a member of the academy, for claiming a madrigal of Lotti of Venice as his own, threatened the existence of the institution. Dr Greene, who had introduced the madrigal into the academy, took part with Bononcini, and withdrew from the society, taking with him the boys of St Paul's. In 1734 Mr Gates, another member of the society, and master of the children of the royal chapel, retired in disgust; and it was thus deprived of the assistance which the boys afforded it in singing the soprano parts. From this time the academy became a seminary for the instruction of youth in the principles of music, and the laws of harmony. Dr Pepusch, who was one of its founders, was active in accomplishing this measure; and by the expedients of educating boys for their purpose, and admitting auditor members, the subsistence of the academy was continued. The *Royal Academy of Music* was formed by the principal nobility and gentry of the kingdom for the performance of operas, composed by Mr Handel, and conducted by him at the theatre in the Haymarket. The subscription amounted to 50,000*l*. and the king, besides subscribing 1000*l*. allowed the society to assume the title of *Royal Academy*. It consisted of a governor, deputy governor, and twenty directors. A contest between Handel and Senesino, one of the performers, in which the directors took the part of the latter, occasioned the dissolution of the academy, after it had subsisted with reputation for more than nine years.

The *Academy of Architecture*, established by M. Colbert in 1671, consisted of a company of skilful architects, under the direction of the superintendent of the buildings.

The *Academy of Dancing*, erected by Lewis XIV. with privileges above all the rest.

VII. *Academies of LAW*; as that famous one at *Be-ryta*, and that of the *Sitientes* at *Bologna*.

VIII. *Academies of HISTORY*; as the *Royal Academy of Portuguese History at Lisbon*. This academy was instituted by King John V. in 1720. It consists of a director, four censors, a secretary, and 50 members; to each of whom is assigned some part of the ecclesiastical or civil history of the nation, which he is to treat either in Latin or Portuguese. In the church-history of each diocese, the prelates, synods, councils, churches, monasteries, academies, persons illustrious for sanctity or learning, places famous for miracles or relics, must be distinctly related in twelve chapters. The civil history comprises the transactions of the kingdom from the government of the Romans down to the present time. The members who reside in the country are obliged to make collections and extracts out of all the registers, &c. where they live. Their meetings to be once in fifteen days.

A medal was struck by this academy in honour of their prince: the front of which was his effigy, with the inscription *Johannes V. Lusitanorum Rex*; and, on the reverse, the same prince is represented standing, and raising History almost prostrate before him, with the legend, *Historia Resurges*. Underneath are the following words in abbreviation: REGIA ACADEMIA HISTORIÆ LUSITANÆ, INSTITUTA VI. Idus Decembris MDCCXX.

Academy of Suabian History at Tübingen was lately established by some learned men, for publishing the best historical writings, the lives of the chief historians, and compiling new memoirs on the several points and periods thereof.

IX. *Academies of ANTIQUITIES*; as that at *Cortona* in Italy, and at *Upsal* in Sweden. The first is designed for the study of *Hetrurian* antiquities; the other for illustrating the northern languages, and the antiquities of Sweden, in which notable discoveries have been made by it. The head of the *Hetrurian* academy is called *Lucomon*, by which the ancient governors of the country were distinguished. One of their laws is to give audience to poets only one day in the year; another is to fix their sessions, and impose a tax of a dissertation on each member in his turn.

The *Academy of Medals and Inscriptions at Paris* was set on foot by M. Colbert, under the patronage of Lewis XIV. in 1663, for the study and explanation of ancient monuments, and perpetuating great and memorable events, especially those of the French monarchy, by coins, relievos, inscriptions, &c. The number of members at first was confined to four or five, chosen out of those of the French academy; who met in the library of M. Colbert, from whom they received his majesty's orders. The days of their meetings were not determined; but generally they met on Wednesdays, especially in the winter season; but, in 1691, the king having given the inspection of this academy to M. de Pontchartrain comptroller general, &c. he fixed their meetings on Tuesdays and Saturdays.

By a new regulation, dated the 16th of July 1701 the academy was composed of ten *honorary* members; ten *associates*; each of whom had two declarative voices, ten *pensionaries*; and ten *elevés*, or pupils. They then

Academies. met every Tuesday and Wednesday, in one of the halls of the Louvre; and had two public meetings yearly, one the day after Martinmas, and the other the 16th after Easter. The class of *eleves* was suppressed, and united to the associates. The king nominated their president and vice-president yearly; but their secretary and treasurer were perpetual. The rest were chosen by the members themselves, agreeably to the constitutions on that behalf given them.

One of the first undertakings of this academy, was to compose, by means of medals, a connected history of the principal events of Louis XIV's reign: but in this design they met with great difficulties, and of consequence it was interrupted for many years; but at length it was completed down to the advancement of the duke of Anjou to the crown of Spain.

In this celebrated work, the establishment of the academy itself was not forgotten. The medal on this subject represents Mercury sitting, and writing with an antique stylus on a table of brass; he leans with his left hand on an urn full of medals, and at his feet are several others placed upon a card: the legend, *Rerum gestarum fides*; and on the exergue, *Academia regia inscriptionum et numismatum, instituta M.DC.LXIII.* signifying that the Royal Academy of Medals and Inscriptions, founded in 1663, ought to give to future ages a faithful testimony of all great actions. Besides this work, we have several volumes of their memoirs; and their history written and continued by their secretaries.

X. *Academies of BELLES LETTRES*, are those wherein eloquence and poetry are chiefly cultivated. These are very numerous in Italy, and were not uncommon in France.

The Academy of *Umbidi at Florence* has contributed greatly to the progress of the sciences, by the excellent Italian translations given, by some of its members, of the ancient Greek and Latin historians. Their chief attention is to the Italian poetry, at the same time that they have applied themselves to the polishing of their language, which produced the *Academy della Crusca*.

The Academy of *Humorists, Umoristi*, had its origin at Rome from the marriage of Lorenzo Marcini, a Roman gentleman, at which several persons of rank were guests; and, it being carnival time, to give the ladies some diversion, they took themselves to the reciting of verses, sonnets, speeches, first *extempore*, and afterwards premeditatedly; which gave them the denomination of *Belli Humori*. After some experience, coming more and more into the taste of these exercises, they resolved to form an academy of belles lettres; and changed the title of *Belli Humori* for that of *Humoristi*: choosing for their device a cloud, which, after being formed of exhalations from the salt waters of the ocean, returns in a gentle sweet shower; with this motto from Lucretius, *Redit agmine dulci*.

In 1690, the Academy of *Arcadi* was established at Rome for reviving the study of poetry and of the belles lettres. Besides most of the politer wits of both sexes in Italy, this academy comprehends many princes, cardinals, and other ecclesiastics; and, to avoid disputes about pre-eminence, all appear masked after the manner of Arcadian shepherds. Within ten years from its first establishment, the number of *Aca-*

demists amounted to six hundred. They hold assemblies seven times a year, in a mead or grove, or in the gardens of some noblemen of distinction. Six of these meetings are employed in the recitation of poems and verses of the *Arcadi* residing at Rome; who read their own compositions; except ladies and cardinals, who are allowed to employ others. The seventh meeting is set apart for the compositions of foreign or absent members.

This academy is governed by a *custos*, who represents the whole society, and is chosen every four years, with a power of electing 12 others yearly for his assistance. Under these are two sub-custodes, one vicar or pro-custos, and four deputies or superintendants, annually chosen. The laws of the society are immutable, and bear a near resemblance to the ancient model.

There are five modes of electing members. The first is by *acclamation*. This is used when sovereign princes, cardinals, and ambassadors of kings, desire to be admitted; and the votes are then given *viva voce*. The second is called *annumeration*. This was introduced in favour of ladies and academical colonies, where the votes are taken privately. The third, *representation*, was established in favour of colonies and universities, where the young gentry are bred; who have each a privilege of recommending one or two members privately to be balloted for. The fourth, *surrogation*; whereby new members are substituted in the room of those dead or expelled. The last, *destination*; whereby, when there is no vacancy of members, persons of poetical merit have the title of *Arcadi* conferred upon them till such time as a vacancy shall happen. All the members of this body, at their admission, assume new pastoral names, in imitation of the shepherds of Arcadia. The academy has several colonies of *Arcadi* in different cities of Italy, who are all regulated after the same manner.

XI. *Academies of LANGUAGES*; called by some, *Grammatical Academies*: as,

The Academy of *della Crusca at Florence*, famous for its vocabulary of the Italian tongue, was formed in 1582, but scarce heard of before the year 1584, when it became noted for a dispute between Tasso and several of its members. Many authors confound this with the Florentine academy. The discourses which Torricelli, the celebrated disciple of Galileo, delivered in the assemblies, concerning levity, the wind, the power of percussion, mathematics, and military architecture, are a proof that these academies applied themselves to things as well as words.

The Academy of *Fructiferi* had its rise in 1617 at an assembly of several princes and nobility of the country, who met with a design to refine and perfect the German tongue. It flourished long under the direction of princes of the empire, who were always chosen presidents. In 1668, the number of members arose to upwards of 900. It was prior in time to the French academy, which only appeared in 1629, and was not established into an academy before the year 1635. Its history is written in the German tongue by George Neumarch.

The French Academy, which had its rise from a meeting of men of letters in the house of M. Conrart, in 1629. In 1635, it was erected into an academy, by Cardinal Richlieu,

Academies.

Richlieu, for refining and ascertaining the French language and style. The number of its members was limited to 40; out of whom a director, chancellor, and secretary, were to be chosen: the two former held their posts for two months, the latter was perpetual. The members of this academy enjoyed several privileges and immunities, among which was that of not being obliged to answer before any court but that of the king's household. They met three times a-week in the Louvre; at breaking up, 40 silver medals were distributed among them, having on one side the king of France's head, and on the reverse, *Protecteur de l'Academie*, with laurel, and this motto, *A l'Immortalité*. By this distribution, the attendance of the *Academists* was secured: those who were present received the surplus otherwise intended for the absent. To elect or expel a member, at least 18 were required; nor could any be chosen unless he petitioned for it: by this expedient, the affront of refusals from persons elected was avoided. Religious were not admitted; nor could any nobleman, or person of distinction, be admitted on another footing than as a man of letters. None were to be expelled, except for base and dishonest practices; and there were but two instances of such expulsions, the first of M. Granier for refusing to return a deposit, the other of the Abbé Furetiere for plagiarism. The design of this academy was to give not only rules, but examples, of good writing. They began with making speeches on subjects taken at pleasure, about 20 of which were printed. They met with great opposition from the parliament at their first institution; it being two years before the patents granted by the king could be registered. They have been severely satirized, and their style has been ridiculed as enervating instead of refining the French language. They are also charged with having surfeited the world by flattery, and having exhausted all the topics of panegyric in praise of their founder; it being a duty incumbent on every member, at his admission, to make a speech in praise of the king, the cardinal, the chancellor Seguier, and the person in whose place he is elected. The most remarkable work of this academy is a dictionary of the French tongue; which, after 50 years spent in settling the words and phrases to be used in writing, was at last published in 1694.

The foundation of an academy similar to the above has been proposed at Petersburg by the learned Princess Dashkof: it is to consist of 60 members. The plan was approved by the late empress, who gave a fund for its support and establishment.

The Royal Spanish Academy at Madrid held its first meeting in July 1713, in the palace of its founder, the Duke d'Escalona. It consisted at first of eight academists, including the duke; to which number 14 others were afterwards added, the founder being chosen president or director. In 1714, the king granted them his confirmation and protection. Their device is a crucible in the middle of the fire, with this motto, *Lim-pia, Fya, y da Esplendor*; "It purifies, fixes, and gives brightness." The number of members is limited to 24; the duke d'Escalona to be director for life, but his successors chosen yearly, and the secretary to be perpetual. Their object, as marked out by the royal declaration, was to cultivate and improve the national language: they were to begin with choosing carefully

such words and phrases as have been used by the best Spanish writers; noting the low, barbarous, or obsolete ones; and composing a dictionary wherein these may be distinguished from the former.

XII. *Academies of POLITICS*; as that at Paris, which consisted of six persons, who met at the Louvre, in the chamber where the papers relating to foreign affairs were lodged. This academy proved of little service, as the kings of France were unwilling to trust any but their ministers with the inspection of foreign affairs.

For a further account of similar establishments, see the article SOCIETY in this work, and the article ACADEMY in the SUPPLEMENT.

ACADEMY is also a term for schools and other seminaries of learning among the Jews, where their rabbins and doctors instructed their youth in the Hebrew language, and explained to them the Talmud and the secrets of the Cabbala: Those of Tiberias and Babylon have been the most noted.

The Romans had a kind of military academies, established in all the cities of Italy, under the name of *Campi Martis*. Here the youth were admitted to be trained for war at the public expence. The Greeks, beside academies of this kind, had military professors called *Tactici*, who taught all the higher offices of war, &c. &c.

ACADEMY is often used with us to denote a kind of collegiate seminary, where youth are instructed in arts and sciences. There is one at Portsmouth for teaching navigation, drawing, &c. which was founded by George I. in 1722; another at Woolwich, for fortification, gunnery, &c. established by George II. in 1741.—An account of these two institutions, and of the Royal Military College at Marlow, will be found under the article ACADEMY, in the SUPPLEMENT.

The nonconformist ministers, &c. are bred up in private academies; as not approving the common university education. There are several academies of this description in different parts of England.

ACADEMY is likewise a name given to a riding-school where young gentlemen are taught to ride the great horse, &c. and the ground allotted is usually called the *Manege*.

ACADEMY Figure, a drawing of a naked man or woman, taken from the life; which is usually done on paper with red or black chalk, and sometimes with pastils or CRAYONS.

ACADIE, or ACADY, in *Geography*, a name formerly given to Nova Scotia, or New Scotland, in America. See *Nova Scotia*.

ACÆNA, in antiquity, a Grecian measure of length, being a ten-feet rod, used in measuring their lands.

ACENÆ, in *Botany*. See BOTANY Index.

ACAJOU, or CASHEW-NUT TREE. See ANACARDIUM, BOTANY Index.

ACALANDRUS, a river falling into the bay of Tarentum, not far from the Metapontum (Pliny, Strabo); now called *Fiume de Roseto*.

ACALEPTIC, in ancient prosody, a complete verse.

ACALYPHA, the THREE-SEEDED MERCURY. See BOTANY Index.

ACALZIKE, a town and fortress of Asiatic Tартary, situated in N. Lat. 41. 30. E. Long. 44. 14.

ACAMANTIS,

Academies
||
Acalzike.

Acamantis
||
Acapulco.

ACAMANTIS, the ancient name of the island of Cyprus, taken from one of its promontories situated to the west, and called *Acamas*. Teos in Ionia was also called thus from Acamas the founder.

ACAMAS, ACAMANTIS, in *Ancient Geography*, the west promontory of the island of Cyprus, from whence it took its ancient name; now Cape *Pisanio*, or *Episanio*, where formerly was a town of the same name, now a village called *Crusocco*.

ACAMAS, son of Theseus, followed the rest of the Grecian princes to the siege of Troy; and was deputed, with Diomedes, to the Trojans, in order to get Helen restored. Laodice, Priam's daughter, fell in love with him, stole a night with him, and had a son by him called *Munitus*. He was one of the heroes who concealed themselves in the wooden horse. One of the tribes of Athens was called *Acamantides* from him, by the appointment of the oracle; and he founded a city in Phrygia Major, called *Acamantium*. Homer mentions two other heroes of this name; one a Thracian prince who came to succour Priam, another a son of Antenor.

ACANGIS, that is, *Ravagers* or *Adventurers*; a name which the Turks give their hussars or light troops, who are generally sent out in detachments to procure intelligence, harass the enemy, or ravage the country.

ACANTHA, in *Botany*, the prickly of any plant; in *Zoology*, a term for the spine or prickly fins of fishes.

ACANTHABOLUS, in *Surgery*, an instrument for pulling thorns, or the like, out of the skin.

ACANTHINE, any thing resembling or belonging to the herb acanthus. Acanthine garments, among the ancients, are said to be made of the down of thistles; others think they were garments embroidered in imitation of the acanthus.

ACANTHOPTERYGIOUS FISHES, a term used by Linnæus and others for those fishes whose back fins are hard, osseous, and prickly.

ACANTHOS, ACANTHUS, a town of Egypt, near Memphis, (Pliny); now *Bisalta*. Also a maritime town of Macedonia, to the west of Mount Athos; a colony of Andrians (Thucydides, Ptolemy); now *Erizzo*; near which was shown Xerxes's ditch of seven stadia, in order to separate Mount Athos from the continent, and convey his ships, without doubling Athos, into the Singitic bay. *Acanthos* is also a town of Epirus.

ACANTHUS, BEAR'S BREECH, in *Botany*. See *BOTANY Index*.

ACANTHUS, in *Architecture*, an ornament representing the leaves of the acanthus, used in the capitals of the Corinthian and Composite orders.

ACAPALA, or ACAPULA, a town in the province of Chiapa, in New Spain, which is situated on Tabasco river, about five leagues north-west from Chiapa.

ACAPAM, a town of Asia on the Euxine sea.

ACAPULCO, a considerable town and port in Mexico, on a bay of the South sea, distant from the city of Mexico south-east 210 miles. It has a remarkably fine harbour, from whence a ship annually sails to Manilla in the Philippine islands in Asia; and another returns annually from thence with all the trea-

asures of the East Indies, such as diamonds, rubies, sapphires, and other precious stones; the rich carpets of Persia; the camphire of Borneo; the benjamin and ivory of Pegu and Cambodia; the silks, muslins, and calicoes, of the Mogul's country; the gold dust, tea, china ware, silk, and cabinets, of China and Japan; besides cinnamon, cloves, mace, nutmegs, and pepper; insomuch that this single ship contains more riches than many whole fleets. The goods brought to Acapulco are carried to the city of Mexico by mules and pack horses; and from thence to Vera Cruz on the North sea, in order to be shipped for Europe. Acapulco is but a small place, containing about 4000 inhabitants, mostly people of colour; which are increased to 9000 by the resort of strangers to the annual fair, held when the Manilla galleon arrives. A wretched fort, with 31 pieces of cannon, defends the harbour. It is equally extensive, safe, and commodious. The bason which constitutes this harbour is surrounded by lofty mountains, which are so dry, that they are even destitute of water. The air here is hot, heavy, and unwholesome; to which none can habituate themselves except certain negroes that are born under a similar climate, or some mulattoes. Upon the arrival of the galleons, traders flock here from all the provinces of Mexico, to exchange European toys, with their own cochineal and silver, for spices, muslin, printed linens, silk, perfumes, and the gold works of Asia. The value of the precious metals exported in the galleon, amounts in general to about 200,000*l.* or 250,000*l.*; the value of the goods to about 300,000*l.* or 400,000*l.*, according to Humboldt. W. Long. 99. 46. N. Lat. 16. 50.

ACARAI, a town of Paraguay in South America, built by the Jesuits in 1624. W. Long. 51. 5. S. Lat. 26.

ACARAUNA, a small American fish, called by our sailors *the old wife*. See *LABRUS, ICHTHYOLOGY Index*.

ACARI, PORT, in *Geography*, lies on the coast of Pern, in S. Lat. 15. 50. W. Long. 54. 40.

ACARNANIA, the first country of Free Greece, or Greece Proper, bounded on the west by the Sinus Ambracius, and separated from Ætolia by the river Achelous on the east, and by the Sinus Ambracius from Epirus. The people were called *Acarnanes*, denoting persons unshorn; other Ætolians, to the east of the Achelous, being called *Curetes* (Homer) from being shorn. According to Lucian, they were noted for effeminacy and incontinence; hence the proverb *Porcellus Acarnanius*. This country was famous for an excellent breed of horses; so that *Ακαρνικός ἵππος*, is a proverbial saying for a thing excellent in its kind. It is now called *il Carnia* and *il Despotato*.

ACARON, or ACCARON, a town of Palestine, called *Ekron* in Scripture. It was the boundary of the Philistines to the north; stood at some distance from the sea, near Bethshemesh; and was famous for the idol of Baalzebub.

ACARUS, the TICK or MITE. See *ENTOMOLOGY Index*.

ACASTUS, in classic history, the son of Pelias, king of Thessaly, and one of the most famous hunters of the time, married Hippolita, who falling desperately in love with Peleus her son-in-law, and he refusing to

Acapulco
||
Acastus.

Acastus
||
Accedas.

gratify her wishes, she accused him to her husband of a rape: on which he slew them both.

ACATALECTIC, a term in ancient poetry for such verses as have all their feet or syllables, in contradistinction to those that have a syllable too few. The first verse of the two following from Horace is *acatalectic* or complete, the last is *catalectic* or deficient.

*Solvitur acris hyems, grata vice veris et Favoni:
Traluniquē siccās machinæ carinas—*

ACATALEPSY, signifies the impossibility of comprehending something. The distinguishing tenet of the Pyrrhonists was their asserting an absolute acatalepsy in regard to every thing.

ACATERY, or **ACCATRY**, anciently an officer of the king's household, designed for a check betwixt the clerks of the kitchen and the purveyors.

ACATHARSIA, in *Medicine*, an impurity of the blood or humours.

ACATHISTUS, the name of a solemn hymn or vigil, anciently sung in the Greek church on the Saturday of the fifth week of Lent, in honour of the Virgin, for having thrice delivered Constantinople from the invasions of the barbarous nations. It was denominated *ακαθιστος*, i. e. *without sitting*, because, in the celebration of the praises of the virgin, the people stood all night singing.

ACATIUM, in *Ancient Navigation*, a kind of boat or pinnace used for military purposes. The *acatium* was a species of those vessels called *naves actuariæ*, i. e. such as were wrought with oars. It was sometimes made use of in battle. Strabo describes it as a privateer or pirate sloop, and Suidas, as a fishing vessel.

ACAULIS, in *Botany*, a term applied to certain plants, the flowers of which have no pedicle or stalk to support them, but rest immediately on the ground, such as the carline thistle, &c.

ACCA, SAINT, bishop of Hagustaldt, or Hexham, in Northumberland, succeeded Wilfrid in that see in 709. He ornamented his cathedral in a most magnificent manner; furnished it with plate and holy vestments; and erected a noble library, consisting chiefly of ecclesiastical learning, and a large collection of the lives of the saints, which he was at great pains to procure. He was accounted a very able divine, and was famous for his skill in church music. He wrote several books: particularly, *Passiones Sanctorum*, The Sufferings of the Saints: *Pro illustrandis Scripturis*, ad Bedam, For explaining the Scriptures, addressed to Bede. He died in 740, having enjoyed the see of Hexham 31 years, under Egbert king of the Northumbrians.

ACALIA, in Roman antiquity, solemn festivals held in honour of Acca Laurentia, Romulus's nurse: they were otherwise called **LAURENTALIA**.

ACCAPITARE, in *Law*, the act of becoming vassal of a lord, or of yielding him homage and obedience. Hence,

ACCAPITUM signifies the money paid by a vassal upon his admission to a feu.

ACCAPITUM, in our *Ancient Law*, was used also to express the relief due to the chief lord. See **RELIEF**.

ACCEDAS AD CURIAM, in *English Law*, a writ lying where a man has received, or fears, false judge-

ment in an inferior court. It lies also for justice delayed, and is a species of the writ **RECORDARE**.

ACCELERATION, in *Mechanics*, the increase of velocity in a moving body. Accelerated motion is that which continually receives fresh accessions of velocity. Acceleration stands directly opposed to *retardation*, which denotes a diminution of velocity.

ACCELERATION is chiefly used, in *Physics*, in respect of falling bodies, i. e. of heavy bodies tending towards the centre of the earth by the force of gravity. That natural bodies are accelerated in their descent, is evident from various considerations, both *à priori* and *posteriori*.—Thus, we actually find, that the greater height a body falls from, the greater impression it makes, and the more vehemently does it strike the subject plane, or other obstacle.

Various were the systems and opinions which philosophers produced to account for this acceleration. But the immediate cause of acceleration is now sufficiently obvious; the principle of gravitation, which determines the body to descend, determining it to be accelerated by a necessary consequence.

Suppose a body let fall from on high: the primary cause of its beginning to descend is doubtless the power of gravity; but when once the descent is commenced, that state becomes in some measure natural to the body; so that if left to itself, it would persevere in it for ever, even though the first cause should cease: as we see in a stone cast with the hand, which continues to move after it is left by the cause that gave it motion. But, beside the propensity to descend impressed by the first cause, and which of itself were sufficient to continue the same degree of motion, once begun, *in infinitum*; there is a constant accession of subsequent efforts of the same principle, gravity, which continues to act on the body already in motion, in the same manner as if it were at rest. Here, then, being a double cause of motion; and both acting in the same direction, viz. directly towards the centre of the earth; the motion they jointly produce must necessarily be greater than that of any one of them.—And the velocity thus increased having the same cause of increase still persisting, the descent must necessarily be continually accelerated.

The motion of a body ascending, or impelled upwards, is diminished or retarded from the same principle of gravity acting in a contrary direction, in the same manner as a falling body is accelerated: See **RETARDATION**. A body thus projected upwards, rises till it has lost all its motion: which it does in the same time that a body falling would have acquired a velocity equal to that wherewith the body was thrown up. Hence the same body thrown up, will rise to the same height from which falling it would have acquired the velocity wherewith it was thrown up: and hence the heights which bodies thrown up with different velocities do ascend to, are to one another as the squares of these velocities.

ACCELERATION of Bodies on inclined Planes. The same general law obtains here as in bodies falling perpendicularly: the effect of the plane is to make the motion slower; but the inclination being everywhere equal, the retardation arising therefrom will proceed equally in all parts, at the beginning and the ending of the motion. See **MECHANICS**.

ACCELERATION

Accedas,
Acceleration.

Acceler-
ation.

ACCELERATION of the Motion of Pendulums.—The motion of pendulous bodies is accelerated in their descent; but in a less ratio than that of bodies falling perpendicularly. See *MECHANICS* and *PENDULUM*.

ACCELERATION of the Motion of Projectiles. See *PROJECTILES*.

ACCELERATION is also applied in the ancient astronomy, in respect of the fixed stars. This acceleration was the difference between the revolution of the *primum mobile* and the solar revolution; which was computed at 3 minutes and 56 seconds.

ACCELERATION of the Moon, a term used to express the increase of the moon's mean motion from the sun, compared with the diurnal motion of the earth; so that it is now a little swifter than it was formerly. Dr Halley was the first who made this discovery; and he was led to it by comparing the ancient eclipses observed at Babylon with those observed by Albatennius in the ninth century, and some of his own time. He was not able to ascertain the quantity of this acceleration, because the longitudes of Bagdad, Alexandria, and Aleppo, where the observations were made, had not been accurately determined. But since his time, the longitude of Alexandria has been ascertained by Chazelles; and Babylon, according to Ptolemy's account, lies 50' east from Alexandria. From these data, Mr Dunthorn compared several ancient and modern eclipses, with the calculations of them, by his own tables, and hereby verified Dr Halley's opinion; for he found that the same tables represent the moon's place more backward than her true place in ancient eclipses, and more forward than her true place in later eclipses, and thence justly inferred that her motion in ancient times was slower, in later times quicker, than the tables give it. But he did not content himself with merely ascertaining the fact; he proceeded to determine the quantity of the acceleration; and by means of the most ancient eclipse of which any authentic account remains, observed at Babylon in the year before Christ 721, he concluded, that the observed beginning of this eclipse was not above an hour and three quarters before the beginning by the tables; and therefore the moon's true place could precede her place by computation but little more than 50' of a degree at that time. Admitting the acceleration to be uniform, and the aggregate of it as the square of the time, it will be at the rate of about 10' in 100 years.

Dr Long attributes the acceleration above described to one or more of these causes: either, 1. The annual and diurnal motion of the earth continuing the same, the moon is really carried round the earth with a greater velocity than heretofore: or, 2. The diurnal motion of the earth, and the periodical revolution of the moon, continuing the same, the annual motion of the earth round the sun is a little retarded; which makes the sun's apparent motion in the ecliptic a little slower than formerly; and, consequently, the moon, in passing from any conjunction with the sun, spends less time before she again overtakes the sun, and forms a subsequent conjunction: in both these cases, the motion of the moon from the sun is really accelerated, and the synodical month actually shortened. Or, 3. The annual motion of the earth, and the periodical revolution of the moon continuing the same, the rotation of the earth round its axis is a little retarded: in this case,

days, hours, minutes, seconds, &c. by which all periods of time must be measured, are of a longer duration; and consequently the synodical month will appear to be shortened, though it really contains the same quantity of absolute time as it always did. If the quantity of matter in the body of the sun be lessened by the particles of light continually streaming from it, the motion of the earth round the sun may become slower: if the earth increases in bulk, the motion of the moon round the earth may be quickened thereby. See *ASTRONOMY*.

ACCELERATION of a Planet. A planet is said to be accelerated in its motion when the real diurnal motion exceeds the mean diurnal motion. On the other hand, a planet is said to be retarded in its motion when the mean motion exceeds the real diurnal motion. This inequality arises from the change in the distance of the planet from the sun, which is continually varying; the planet moving always quicker in its orbit when nearer the sun, and slower when farther off.

ACCELERATOR, in *Anatomy*, the name of two muscles of the penis, which serve for ejecting the urine or semen. See *ANATOMY*, *Table of the Muscles*.

ACCIDENTES, a lower order of ministers in the Romish church, whose office is to light and trim the candles.

ACCENDONES, in Roman antiquity, a kind of gladiators, whose office was to excite and animate the combatants during the engagement. The orthography of the word is contested: the first edition of Tertullian, by Rhenanus, has it *accedones*; an ancient manuscript, *accendones*. Aquinas adheres to the former, Pitiscus to the latter. The origin of the word, supposing it *accendones*, is from *accendo*, I kindle; supposing it *accedones*, from *accedo*, I accede, am added to. The former places their distinguishing character in enlivening the combat by their exhortations and suggestions: the latter supposes them to be much the same with what among us are called *seconds*, among the Italians, *patroni*; excepting that these latter only stand by to see the laws of the sword duly observed, without intermeddling to give advice or instruction.

ACCENSI, in the Roman armies, certain supernumerary soldiers, designed to supply the places of those who should be killed or anywise disabled. They were thus denominated, *quia accensebantur*, or *ad census ad-jiciebantur*. Vegetius calls them *supernumerarii legionum*. Cato calls them *ferentarii*, in regard they furnished those engaged in battle with weapons, drink, &c. Though Nonnius suggests another reason of that appellation, viz. because they fought with stones, slings and weapons *quæ feruntur*, such as are thrown, not carried in the hand. They were sometimes also called *velites*, and *velati*, because they fought clothed, but not in armour: sometimes *adscriptitii*, and *adscriptivi*; sometimes *rorarii*. The *accensi*, Livy observes, were placed at the rear of the army, because no great matter was expected from them; they were taken out of the fifth class of citizens.

ACCENSI, in antiquity, denotes an inferior order of officers, appointed to attend the Roman magistrates, somewhat in the manner of ushers, serjeants or tipstaves among us. They were thus called from *accire*, to send for; one part of their office being to call assemblies

Acceler-
ation
||
Accensi.

Accensi
||
Accent.

of the people, summon parties to appear and answer before the judges, &c.

ACCENSI was also an appellation given to a kind of adjutants, appointed by the tribune to assist each centurion and decurion. In which sense *accensus* is synonymous with *optio*. In an ancient inscription, given by Torre, we meet with ACCENSUS EQUITUM ROMANORUM; an office nowhere else heard of. That author suspects it for a corruption; and instead thereof reads, A CENSIBUS.

ACCENSION, the action of setting a body on fire: thus the accension of tinder is effected by striking fire with flint and steel.

ACCENT, in *reading or speaking*, an inflection of the voice, which gives to each syllable of a word its due pitch in respect of height or lowness. See *READING*. The word is originally Latin, *accentus*; a compound of *ad*, to, and *canto*, to sing. *Accentus*, *quasi ad-cantus*, or *juxta cantum*. In this sense, accent is synonymous with the Greek *ῥυθμός*; the Latin *tenor*, or *tonor*; and the Hebrew *טעם*, *gustus*, taste.—For the doctrine of *Accents*, in *Composition*, see *POETRY*, Part III.

ACCENT, among grammarians, is a certain mark or character placed over a syllable to direct the stress of its pronunciation. We generally reckon three grammatical accents in ordinary use, all borrowed from the Greeks, viz. the *acute accent*, ('), which shows when the tone of the voice is to be raised. The *grave accent* (`), when the note or tone of the voice is to be depressed. The *circumflex accent* (^), is composed of both the acute and the grave, and points out a kind of undulation of the voice. The Latins have made the same use of these three accents.

The Hebrews have a grammatical, a rhetorical, and musical accent: though the first and last seem, in effect, to be the same; both being comprised under the general name of *tonic accents*, because they give the proper tones to syllables; as the rhetorical accents are said to be euphonic, because they tend to make the pronunciation more sweet and agreeable. There are four euphonic accents, and 25 tonic; of which some are placed above, and others below the syllables; the Hebrew accents serving not only to regulate the risings and fallings of the voice, but also to distinguish the sections, periods, and members of periods, in a discourse; and to answer the same purposes with the points in other languages. Their accents are divided into *emperors*, *kings*, *dukes*, &c. each bearing a title answerable to the importance of the distinction it makes. Their emperor rules over a whole phrase, and terminates the sense completely; answering to our point. Their king answers to our colon; and their duke to our comma. The king, however, occasionally becomes a duke, and the duke a king, as the phrases are more or less short. It must be noted, by the way, that the management and combination of these accents differ in Hebrew poetry from what they are in prose. The use of the tonic or grammatical accents has been much controverted; some holding that they distinguish the sense; while others maintain that they are only intended to regulate the music, or singing; alleging that the Jews sing, rather than read, the Scriptures in their synagogues*. Be this, however, as it will, it is certain the ancient Hebrews were not acquainted with these accents. The opinion which prevails amongst the

Accent.

learned is, that they were invented about the sixth century, by the Jewish doctors of the school of Tiberias, called the *Massorcts*.

As to the Greek accents, now seen both in manuscripts and printed books, there has been no less dispute about their antiquity and use than about those of the Hebrews. Isaac Vossius endeavours to prove them of modern invention; asserting, that anciently they had nothing of this kind, but only a few notes in their poetry, which were invented by Aristophanes the grammarian, about the time of Ptolemy Philopater; and that these were of musical, rather than grammatical use, serving as aids in the singing of their poems, and very different from those introduced afterwards. He also shows from several ancient grammarians, that the manner of writing the Greek accents in these days was quite different from that which appears in our books. The author of *La Methode Greque*, p. 546, observes, that the right pronunciation of the Greek language being natural to the Greeks, it was needless for them to mark it by accents in their writings: so that, according to all appearance, they only began to make use of them about the time, when the Romans, wishing to learn the Greek tongue, sent their children to study at Athens, thinking thereby to fix the pronunciation, and to facilitate it to strangers; which happened, as the same author observes, a little before Cicero's time. Wetstein, Greek professor at Basil, in a learned dissertation, endeavours to prove the Greek accents of an older standing. He owns that they were not always formed in the same manner by the ancients; but thinks that difference owing to the different pronunciation which obtained in the different parts of Greece. He brings several reasons, *a priori*, for the use of accents, even in the earliest days: as that they then wrote all in capital letters equidistant from each other, without any distinction either of words or phrases, which without accents could scarce be intelligible; and that accents were necessary to distinguish ambiguous words, and to point out their proper meaning: which he confirms from a dispute on a passage in Homer, mentioned by Aristotle in his *Poëtics*, chap. v. Accordingly, he observes, that the Syrians, who have tonic, but no distinctive accents, have yet invented certain points, placed either below or above the words, to show their mood, tense, person, or sense.

Mr Browne of Trinity College, Dublin, has entered more deeply into this investigation; and as he had an opportunity of conversing with the crew of a Greek ship from Patrass, a town situated not far distant from the ancient Corinth, which had been driven by stress of weather into the port of Dingle in Ireland, the result of his inquiries was, that the practice of the modern Greeks is different from any of the theories that have been delivered in books. "It is true, he observes, they have not two pronunciations for prose and for verse, and in both they read by accent, but they make accent the cause of quantity; they make it govern and controul quantity; they make the syllable long on which the acute accent falls, and they allow the acute accent to change the real quality. They always read poetry as well as prose by accent. Whether any inference can hence be drawn as to the pronunciation of the ancients, I must leave, after what I have premised above, to men of more learning, but I think it at least so probable as to make it worth while to mention the

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instances

Accent.

instances which occurred in proof of this assertion more particularly. Of the two first persons whom I met, one, the steward of the ship, an inhabitant of the island of Cephalaria, had had a school education: he read Euripides, and translated some easier passages without much difficulty. By a stay in this country of near two years, he was able to speak English very tolerably, as could the captain and several of the crew; and almost all of them spoke Italian fluently. The companion, however, of the steward could speak only modern Greek, in which I could discover that he was giving a description of the distress in which the ship had been, and though not able to understand the context, I could plainly distinguish many words, such as *δενδρα*—*ξύλον*, and among the rest the sound of *Ἀνθρώπος* pronounced short; this awoke my curiosity, which was still more heightened when I observed that he said *Ἀνθρώπων* long, with the same attention to the alteration of the accent with the variety of case, which a boy would be taught to pay at a school in England. Watching therefore more closely, and asking the other to read some ancient Greek, I found that they both uniformly pronounced according to accent, without any attention to long or short syllables where accent came in the way; and on their departure, one of them having bade me good day, by saying *Καλημέρα*, to which I answered *Καλημέρα*, he with strong marks of reprobation set me right, and repeated *Καλημέρα*; and with like censure did the captain upon another occasion observe upon my saying *Σοκράτης* instead of *Σοκράτες*.

"I now had a strong wish to know whether they observed the distinction in this respect usually between verse and prose, but from the little scholarship of the two men with whom I had conversed, from the ignorance of a third whom I afterwards met, (who however read Lucian with ease, though he did not seem ever to have heard of the book), and on account of my imperfect mode of conversing with them all, I had little hopes of satisfaction on the point, nor was I clear that they perfectly knew the difference between verse and prose. At length having met with the commander of the ship, and his clerk Athanasius Κο νομος, and finding that the latter had been a schoolmaster in the Morea, and had here learnt to speak English fluently, I put the question to them in the presence of a very learned college friend, and at another time, to avoid any error, with the aid of a gentleman who is perfectly master of the Italian language. Both the Greeks repeatedly assured us that verse as well as prose was read by accent, and not by quantity, and exemplified it by reading several lines of Homer, with whose name they seemed perfectly well acquainted.

"I shall give an instance or two of their mode of reading:

Βῆ δ' ἀκίῳ τὰρ ἐνὶ Σῖνᾳ πολυφλοίσβοιο θαλάσσης,
τὸν δ' ἀπαμειβόμενος προσέφη πόδας ὠκὺς Ἀχιλλεύς,
Ἔς δ' ἔρετας ἐπιπλὴν ἀγείρομεν, ἐς δ' ἐκατόμβην.

They made the *ε* in *ἀκίῳ*, *προσέφη*, and *ἔρετας* long.

But when they read.

Κλυθὶ μιν, Ἀρξὺρτοξ', ὃς Χρύσην ἀμφιέσθηκας,
they made the second syllable of the first word *Κλυθ* short, notwithstanding the acute accent: on my asking

why, they desired me to look back on the circumflex on the first syllable, and said it thence necessarily followed; for it is impossible to pronounce the first syllable with the great length which the circumflex denotes, and not to shorten the second. The testimony of the schoolmaster might be vitiated, but what could be stronger, than that of these ignorant mariners as to the vulgar common practice of modern Greece; and it is remarkable that this confirms the opinion of Bishop Horsley, that the tones of words in connexion are not always the same with the tones of solitary words, though in those of more than one syllable the accentual marks do not change their position. I must here add that these men confirmed an observation which I have heard made, that we are much mistaken in our idea of the supposed lofty sound of *πολυφλοίσβοιο θαλάσσης*; that the borderers on the coast of the Archipelago take their ideas from the gentle laving of the shore by a summer wave, and not from the roaring of a winter ocean, and they accordingly pronounced it *Polyphlisveo thalasses*.

"I own that the observations made by me on the pronunciation of these modern Greeks brought a perfectly new train of ideas into my mind. I propose them, with humility, for the consideration of the learned; but they have made a strong impression upon me, and approached, when compared with other admitted facts, nearly to conviction. In short, I am strongly inclined to believe, that what the famous treatise so often mentioned on the prosodies of the Greek and Latin languages mentions as the peculiarity of the English, that we always prolong the sound of the syllable on which the acute accent falls, is true, and has been true of every nation upon earth. We know it is true of the modern Italians—they read Latin in that respect just as we do, and say, *Armā virūmq̄e cānō*, and, *In novā fert animus*, as much as we. And when we find the modern Greeks following the same practice, surely we have some cause to suppose that the ancients did the same. In the English language, indeed, quantity is not affected, because accent and quantity always agree. Bishop Horsley endeavoured to prove that they did so in Greek, but this is on the bold supposition that the accent doth not fall where the mark is placed. The objection to this hypothesis, which seems to have been admitted by all writers, and considered as decisive by some as to prose, by all as to verse, is that such a mode of pronunciation or reading must destroy metre, or *rhythmos*. From this position, however universal, or however it may have been taken for granted, I totally dissent. That it will oppose the metre or quantity I readily agree, but that it will destroy the *rhythmos*, by which, whatever learned descriptions there may have been of its meaning, I understand nothing more than the melody or smooth flowing of the verses, or their harmony if you please, if harmony be properly applied to successive and not synchronal sounds. On the contrary, nothing can be more disagreeable or unmelodious than the reading verse by quantity, or scanning of it, as it is vulgarly called. Let us try the line so often quoted—

Armā virūmq̄e cānō, Trōjæ qui prīmūs ab ōris,
instead of

Armā virūmq̄e cānō, Trōjæ qui prīmūs ab ōris.
"No

Accent.

Accent.

"No man ever defined *rhythmos* better than Plato, *ordinem quendam qui in motibus cernitur*; the motion or measure of the verse may be exact, and yet the order, arrangement, and disposition of the letters and syllables, such as to be grating and unmelodious to the ear. In like manner the feet of the verse may be exact, but the stress laid upon particular syllables of it which follows the quantity may totally destroy the melody: in short, the radical error seems to be the confusion of quantity with melody, and the supposition that whatever is at war with quantity and metre must be at war with melody.

"It will be asked then what is the use of metre or measure in verse, if we are not to read by it; and here is the grand difficulty, and I own with candour I cannot answer it with perfect satisfaction to my own mind: to those indeed who say we are to read by accent in prose, it may be equally asked what is the use of long or short syllables in prose, if we are not to attend to them when accent comes in the way: but to those who think otherwise, I can only answer, that in the first place accent doth not always interfere, and then quantity is our guide, and accent often accords with quantity. Secondly, Metre determines the number of feet or measures in each verse, and thereby produces a general analogy and harmony through the whole; and it is to be observed, that, as I apprehend, accent doth not change the number of feet, though it doth the nature or species of them. Thus when we read

Arma virumque cāno, Trōjæ qui primus ab oris,

we do not make more feet than when we scan the line, nor employ more time than in pronouncing the next line in which the accent happens to accord with the quantity, viz.

Italiam fato profugus, Lavinaque venit.

Thirdly, the poet in measuring his verse certainly must be confined to some certain number and order of long and short syllables, in order to produce a concordance through the whole, and even to regulate the position of accent, which though not subdued by quantity will certainly have some relation to it, *euphoniæ gratia*; but surely the length or shortness of a syllable cannot determine where emphasis shall be placed—that must depend on the meaning and the thought; and it would be most absurd for the poet to say to the reader, you shall not rest upon this emphatic and significative word because its syllables are short, and wherever there is a rest, there must be length and intonation." (*Irish Trans.* vol. vii.)

The use of accents, to prevent ambiguities, is most remarkably perceived in some eastern languages, particularly the Siamese and Chinese. Among the people of China, every word, or (which is the same thing) syllable, admits of five accents, as spoken more acutely or remissly; and thus stands for many different things. The same sound *ya*, according to the accent affixed to it, signifies *God*, a *wall*, *excellent*, *stupidity*, and a *goose*. The Chinese have but 330 spoken words in their language; but these being multiplied by the different accents or tones, which affect the vowels, furnish a language tolerably copious. By means hereof, their 330 simple sounds come to denote 1650 things; but this being hardly sufficient, they are increased further by

aspirates added to each word to double the number. The Chinese only reckon four *accents*: for which the missionaries use the following marks, *ā, á, â, ã*; to which they have added a fifth, thus *ä*. They make a kind of modulation; wherein, prolonging the duration of the sound of the vowel, they vary the tone, raising and sinking it by a certain pitch of voice: so that their talking is a sort of music or singing. Attempts have been made to determine the quantity of the rise or fall on each accent by means of musical notes; but this is hard to effect, as being different in different persons. Hence the great difficulty of the language to foreigners; they are forced to sing most scrupulously: if they deviate ever so little from the accent, they say quite a different thing from what was intended. Thus, meaning to compliment the person you are talking of with the title *Sir*, you call him a beast with the same word, only a little varied in the tone. Magalhon makes the language the easier to learn on this account. The Siamese are also observed to sing rather than to talk. Their alphabet begins with six characters, all only equivalent to a *K*, but differently accented. For though in the pronunciation the accents are naturally on the vowels, yet they have some to diversify such of their consonants as are in other respects the same.

ACCENT, in *Music*, is a certain enforcement of particular sounds, whether by the voice or instruments, generally used at the beginning of bars.

ACCEPTANCE, in *Law*, a person's agreeing to offers made in bargaining, by which the bargain is concluded.

ACCEPTANCE, in the church of Rome, is put for receiving the pope's constitutions.

ACCEPTANCE, in *Commerce*, is the subscribing, signing, and making one's self debtor for the sum contained in a bill of exchange or other obligation.

ACCEPTATION, in *Grammar*, the sense or meaning in which any word is taken.

ACCEPTER, or ACCEPTOR, the person who accepts a *BILL* of exchange, &c.

ACCEPTILATION, among civilians, an acquittance or discharge given by the creditor to the debtor without the payment of any value.

ACCESSIBLE, something that may be approached, or that access may be had to. Thus we say, Such a place is accessible on one side, &c.

ACCESSION, in *Law*, is a method of acquiring property, by which, in things that have a close connection or dependance upon one another, the property of the principal thing draws after it the property of the accessory: Thus, the owner of a cow becomes likewise the owner of the calf. It sometimes likewise signifies consent or acquiescence.

ACCESSION, among physicians, is used for a paroxysm of a disease; among politicians, it signifies a prince's succeeding to the government upon the death of his predecessor.

ACCESSORY, or ACCESSARY, something that accedes, or is added to another more considerable thing; in which sense the word stands opposed to *PRINCIPAL*.

ACCESSORY, or *Accessary*, in *Common Law*, is chiefly used for a person guilty of a felonious offence, not principally, but by participation: as by advice, command, or concealment.

There are two kinds of *accessories*: *before* the fact, and

Accent

||

Accessory.

Accessory and *after* it. The *first* is he who commands, or procures another to commit felony, and is not present himself; for if he be present he is a principal. The *second* is he who receives, assists, or comforts any man that has done murder or felony, whereof he has knowledge. A man may also be accessory to an accessory, by aiding, receiving, &c. an accessory in felony.

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Acciaïoli.

An accessory in felony shall have judgment of life and member, as well as the principal who did the felony; but not till the principal be first attainted, and convict, or outlawed thereon. Where the principal is pardoned without attainder, the accessory cannot be arraigned; it being a maxim in law, *Ubi non est principalis, non potest esse accessorius*: but if the principal be pardoned, or have his clergy after attainder, the accessory shall be arraigned; 4 and 5 W. et M. cap. 4. And by stat. 1 Anne, cap. 9. it is enacted, that where the principal is convicted of felony, or stands mute, or challenges above 20 of the jury, it shall be lawful to proceed against the accessory in the same manner as if the principal had been attainted; and notwithstanding such principal shall be admitted to his clergy, pardoned, or delivered before attainder. In some cases also, if the principal cannot be taken, then the accessory may be prosecuted for a misdemeanour, and punished by fine, imprisonment, &c. In the lowest and highest offences there are no accessories, but all are principals: as in riots, routs, forcible entries, and other trespasses, which are the lowest offences. So also in the highest offence, which is, according to the English law, high treason, there are no accessories.

Accessories, in petty treason, murder, and in felonies of several kinds, are not to have their clergy. There can be no accessory before the fact in manslaughter: because that is sudden and unrepented.

ACCESSORY Nerves, in *Anatomy*, a pair of nerves, which arising from the medulla in the vertebrae of the neck, ascend, and enter the skull, and pass out of it again with the par vagum, wrapped up in the same common integument, and after quitting them, are distributed into the muscles of the neck and shoulders. See **ANATOMY**.

ACCESSORY, among painters, an epithet given to such parts of a history-piece as serve chiefly for ornament, and might have been wholly left out: such as vases, armour, &c.

ACCI, in *Ancient Geography*, a town of Tarraconensis, formerly called *Acti*; supposed to be *Guadix*, to the east of the city of Granada in Spain, at the foot of a mountain near the source of the rivulet Guadalentin; now greatly decayed. It is the Colonia Aceitana Gemella, and was of some repute among the Roman colonies. The people were called Gemellenses, because the colony consisted of colonists from the third and sixth legions.

ACCIAIOLI, DONATO, a native of Florence, was born in 1428, and was famous for his learning and the honourable employments which he held. He wrote, a Latin translation of some of Plutarch's Lives; Commentaries on Aristotle's Ethics and Politics; and the Lives of Hannibal, of Scipio, and of Charlemagne. He was sent to France by the Florentines, to solicit aid from Louis XI. against Pope Sixtus IV. but on his journey died at Milan in 1478; his body was carried to Florence, and buried in the church of the Carthu-

sians at the public expence. The small fortune he left his children is a proof of his probity and disinterestedness. His daughters, like those of Aristides, were portioned by his fellow-citizens, as an acknowledgement of his services. His funeral eulogium was spoken by Christopher Landini; and an elegant epitaph, by Politian, was inscribed on his tomb.

ACCIDENT, in a general sense, denotes any casual event.

ACCIDENT, among *Logicians*, is used in a threefold sense. 1. Whatever does not essentially belong to a thing; as the clothes a man wears, or the money in his pocket. 2. Such properties in any subject as are not essential to it; thus whiteness in paper is an accidental quality. 3. In opposition to substance, all qualities whatever are called accidents; as sweetness, softness, &c.

ACCIDENT, in *Grammar*, implies a property attached to a word, without entering into its essential definition; for every word, notwithstanding its signification, will be either primitive, derivative, simple, or compound, which are the accidents of words. A word is said to be primitive, when it is taken from no other word in the language in which it is used: thus *heaven, king, good*, are primitive words. It is said to be derivative, when it is taken from some other word: thus *heavenly, kingdom, goodness*, &c. are derivatives. A simple word is easily distinguished from a compound: thus *just, justice*, are simple words; *unjust, injustice*, are compound: *res* is a simple word, as well as *publica*; but *respublica* is a compound. Besides these accidents which are common to all sorts of words, each particular species has its accidents: thus the accidents of the noun substantive are the gender, declension, and number; and the adjective has another accident, namely the comparison. See the articles **GRAMMAR** and **LANGUAGE**.

ACCIDENT, in *Heraldry*, an additional point or mark in a coat of arms, which may be either omitted or retained without altering the essence of the armour; such as abatement, difference, and tincture.

ACCIDENTAL, in a general sense, implies something that happens by accident, or that is not essential to its subject.

ACCIDENTAL, in *Philosophy*, is applied to that effect which flows from some cause intervening by accident, without being subject, or at least without any appearance of being subject, to general laws or regular returns. In this sense, *accident* is opposed to *constant* and *principal*. Thus the sun's place is, with respect to the earth, the constant and principal cause of the heat in summer, and the cold in winter; whereas, winds, snows, and rains, are the accidental causes which often alter and modify the action of their principal cause.

ACCIDENTAL Colours, are those which depend upon the affections of the eye, in contradistinction to those which belong to light itself. The impressions made upon the eye by looking steadfastly on objects of a particular colour are various, according to the single colour or combination of colours in the object; and they continue for some time after the eye is withdrawn, and give a false colouring to other objects. M. Buffon has endeavoured to trace the connections which these accidental colours have with such as are natural, in a variety of instances. The subject has also been considered.

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Acciaïoli.
||
Accidental.

accidental
||
Accius.

considered by De la Hire and M. Æpinus; and M. d'Arcy has contrived a machine for determining the duration of those impressions on the eye; and from the result of several experiments, he inferred, that the effect of the action of light on the eye continued about eight thirds of a minute.

ACCIDENTAL POINT, in *Perspective*, is that point in the horizontal line where the projections of two lines parallel to each other meet the perspective plane.

ACCIPENSER. See **ICHTHYOLOGY** *Indcx.*

ACCIPITER, among the Romans, signified a hawk, which, from its being very carnivorous, they considered as a bird of bad omen:

Odinus accipitrem, quia semper vivit in armis. OVID.

Pliny, however tells us, that in some cases, particularly in marriage, it was esteemed a bird of good omen, because it never eats the hearts of other birds; intimating thereby, that no differences in a married state ought to reach the heart. The accipiter was worshipped as a divinity by the inhabitants of Tentyra, an island in the Nile, being considered by them as the image of the sun; and hence we find that luminary represented, in hieroglyphics, under the figure of a hawk.

ACCIPITRES, the name of Linnæus's first order of birds. See **ORNITHOLOGY**.

ACCISMUS denotes a feigned refusal of something which a person earnestly desires. The word is Latin; or rather Greek, *ακκισμος*; supposed to be formed from *Acco*, the name of a foolish old woman noted in antiquity for an affectation of this kind.

Accismus is sometimes considered as a virtue; sometimes as a vice, which Augustus and Tiberius practised with great success. Cromwell's refusal of the crown of England may be brought as an instance of an *accismus*.

ACCISMUS is more particularly used in *Rhetoric*, as a species of irony.

ACCITUM, in *Ancient Geography*, a town of Hispania Bætica, now *Finiana*, as appears from an ancient inscription; situated on an eminence of the mountains Alpuxaras, in the province of Granada in Spain.

ACCIUS, LUCIUS, a Latin tragic poet, the son of a freedman, and, according to St Jerome, born in the consulship of Hostilius Mancinus and Attilius Serranus, in the year of Rome 583: but there appears somewhat of confusion and perplexity in this chronology. He made himself known before the death of Pacuvius, by a dramatic piece, which was exhibited the same year that Pacuvius brought one upon the stage, the latter being then eighty years of age, and Accius only thirty. We do not know the name of this piece of Accius's, but the titles of several of his tragedies are mentioned by various authors. He wrote on the most celebrated stories which had been represented on the Athenian stage; as *Andromache*, *Andromeda*, *Atræus*, *Clytemnestra*, *Medea*, *Meleager*, *Philoctetes*, the civil wars of Thebes, Tereus, the Troades, &c. He did not always, however, take his subjects from the Grecian story: for he composed one dramatic piece wholly Roman: It was entitled *Brutus*, and related to the expulsion of the Tarquins. It is affirmed by some that he wrote also comedies; which is not unlikely, if he was the author of two pieces, the *Wedding* and the *Merchant*, which have been ascribed to him. He

did not confine himself to dramatic writing; for he left other productions, particularly his annals, mentioned by Macrobius, Priscian, Festus, and Nonnius Marcellus. He has been censured for writing in too harsh a style, but in all other respects has been esteemed a very great poet. He was so much esteemed by the public, that a comedian was punished, for only mentioning his name on the stage. Cicero speaks with great derision of one Accius who had written a history; and, as our author had wrote annals, some insist that he is the person censured: but as Cicero himself, Horace, Quintilian, Ovid, and Paternulus, have spoken of our author with so much applause, we cannot think it is the same person whom the Roman orator censures with so much severity.

There was also in this age a pretty good orator of the same name, against whom Cicero defended Cluentius. He was born in Pisaurum, and perhaps was a relation of our poet.

ACCIUS, a poet of the 16th century, to whom is attributed A Paraphrase of Æsop's Fables, on which Julius Scaliger bestows great encomiums.

ACCLAMATION, a confused noise or shout of joy, by which the public express their applause, esteem, or approbation.

ACCLAMATION, in a more proper sense, denotes a certain form of words, uttered with extraordinary vehemence, and in a peculiar tone somewhat resembling a song, frequent in the ancient assemblies. Acclamations were usually accompanied with applauses, with which they are sometimes confounded: though they ought to be distinguished; as acclamation was given by the voice, applause by the hands: add, that acclamation was also bestowed on persons absent, applause only on those present. Acclamation was also given by women, whereas applause seems to have been confined to men.

Acclamations are of various kinds; ecclesiastical, military, nuptial, senatorial, synodical, scholastical, theatrical, &c. We meet with loud acclamations, musical and rhythmical acclamations; acclamations of joy and respect, and even of reproach and contumely. The former, wherein words of happy omen were used, were also called *Laudationes, et bona vota*, or good wishes; the latter, *Execrationes et convicia*. Suetonius furnishes an instance of this last kind in the Roman senate, on occasion of the decree for demolishing the statues of Domitian, when the fathers, as the historian represents it, could not refrain from contumelious acclamations of the deceased. The like were shown after the death of Commodus, where the acclamations run in the following strain: *Hosti patria honores detrahantur, parricide honores detrahantur; hostis statuas undique, parricide statuas undique, gladiatoris statuas undique, &c.*—The formula, in acclamations, was repeated sometimes a greater, sometimes a lesser, number of times. Hence we find in Roman writers, *acclamatum est quinquies, et vicies*; five times, and twenty times; sometimes also *sexagies*, and even *octuagies*; sixty and eighty times.

Acclamations were not unknown on the theatres in the earliest ages of the Roman commonwealth; but they were artless then, and little other than confused shouts. Afterwards they became a sort of regular concerts. That mentioned by Phædrus, *lætare incolumis Roma salvo principe*, which was made for Augustus, and proved the occasion of a pleasant mistake of a flute-player.

Accius,
Acclamation.

Acclama-
tion.

player called *Princeps*, shows that musical acclamations were in use in that emperor's reign. *Revertentem ex provincia modulatis carminibus prosequabantur*, says Suetonius, who gives another instance in the time of Tiberius: a false report of Germanicus's recovery being spread through Rome, the people ran in crowds to the capitol with torches and victims, singing, *Salva Roma, Salva Patria, Salvus est Germanicus*.—Nero, passionately fond of music, took special care to improve and perfect the music of acclamations. Charmed with the harmony with which the Alexandrians, who came to the games celebrated at Naples, had sung his praises, he brought several over to instruct a number of youth, chosen from among the knights and people, in the different kinds of acclamations practised at Alexandria. These continued in use as long as the reign of Theodoric. But the people did not always make a single chorus; sometimes there were two, who answered each other alternately: thus, when Nero played on the theatre, Burrhus and Seneca, who were on either hand, giving the signal by clapping, 5000 soldiers called *Augustals*, began to chant his praise, which the spectators were obliged to repeat. The whole was conducted by a music-master called *mesochorus* or *pau-sarius*.—The honour of acclamations was chiefly rendered to emperors, their children, and favourites; and to the magistrates who presided at the games. Persons of distinguished merit also sometimes received them, of which Quintilian gives us instances in Cato and Virgil. The most usual forms were, *Felicitèr, Longiorem vitam, Annos felices*. The actors themselves, and they who gained the prizes in the games of the circus, were not excluded the honour of acclamations.

To theatrical acclamations may be added those of the soldiery and the people in time of triumph. The victorious army accompanied their general to the capitol; and, among the verses they sung in his praises, frequently repeated *IO TRIUMPHÈ*, which the people answered in the same strain. It was also in the way of acclamation, that the soldiers gave their general the title of *Imperator*, after some notable victory: a title which he only kept till the time of his triumph.

The acclamations of the senate were somewhat more serious than the popular ones; but arose from the same principles, viz. a desire of pleasing the prince or his favourites; and aimed likewise at the same end, either to express the general approbation and zeal of the company, or to congratulate him on his victories, or to make him new protestations of fidelity. These acclamations were usually given after a report made by some senator, to which the rest all expressed their consent by crying *OMNES, OMNES*; or else, *ÆQUUM EST, JUSTUM EST*. Sometimes they began with acclamations, and sometimes ended with them without other debates. It was after this manner that all the elections and proclamations of emperors, made by the senate, were conducted; something of which practice is still retained at modern elections of kings and emperors, where *Vivat Rex*, and *Long live the King*, are customary forms of acclamation.

The Greeks borrowed the custom of receiving their emperors in the public places from the Romans. Luitprand relates, that at a procession where he was present, they sung to the emperor Nicephorus, *πολλὰ εἴης*;

that is, Many years; which Coddin expresses thus, by *το ψάλλειν το πολυχρονιον*, or by *το πολυχρονιζειν*; and the wish or salutation by *πολυχροισμα*. And at dinner, the Greeks then present wished with a loud voice to the emperor and Bardas, *Ut Deus annos multiplicet*; as he translates the Greek. Plutarch mentions an acclamation so loud, upon occasion of Flaminius's restoring liberty to Greece, that the very birds fell from heaven with the shout. The Turks practise something like this on the sight of their emperors and grand viziers to this day.

For the acclamations with which authors, poets, &c. were received, who recited their works in public; it is to be observed, the assemblies for this purpose were held with great parade in the most solemn places, as the Capitol, temples, the Athenæum, and the houses of great men. Invitations were sent everywhere, in order to get the greater appearance. The chief care was, that the acclamations might be given with all the order and pomp possible. Men of fortune who pretended to wit, kept able applauders in their service, and lent them to their friends. Others endeavoured to gain them by presents and treats. Philostratus mentions a young man named Vavus, who lent money to the men of letters, and forgave the interest to such as applauded his exercises. These acclamations were conducted much after the same manner as those in the theatre, both as to the music and the accompaniments: they were to be suited both to the subject and to the person. There were particular ones for the philosophers, for orators, for historians, and for poets. It would be difficult to rehearse all the forms of them; one of the most usual was *Sophos*, which was to be repeated three times. Martial comprehends several other usual forms in this verse;

Graviter, Citò, Nequiter, Euge, Beatè.

Neither the Greeks nor Romans were barren on this head. The names of gods and heroes were given those whom they would extol. It was not enough to do it after each head of discourse, chiefly after the exordium; but the acclamations were renewed at every fine passage, frequently at every period.

The acclamations with which the spectators honoured the victories of the athletes, were a natural consequence of the impetuous motions which attended the gymnastic games. The cries and acclamations of the people, sometimes expressing their compassion and joy, sometimes their horror and disgust, are strongly painted by different poets and orators.

Acclamations made also a part of the ceremony of marriage. They were used for the omen's sake; being the *Læta Omîna*, sometimes spoken of before marriage in Roman writers.

Acclamations, at first practised in the theatre, and passing thence to the senate, &c. were in process of time received into the acts of councils, and the ordinary assemblies of the church. The people expressed their approbation of the preacher variously; the more usual forms were, *Orthodox! Third Apostle, &c.* These acclamations being sometimes carried to excess, and often misplaced, were frequently prohibited by the ancient doctors, and at length abrogated; though they appear to have been in some use about the time of St Bernard.

Acclama-
tion.

Acclamation
||
Accolti.

ACCLAMATION MEDALS, among *Antiquaries*, such as represent the people expressing their joy in the posture of acclamation.

ACCLIVITY, the rise or ascent of a hill, in opposition to the declivity or descent of it. Some writers on fortification use it for the talus of a rampart.

ACCOLA, among the Romans, signified a person who lived *near* some place; in which sense, it differed from *incola*, the *inhabitant* of such a place.

ACCOLADE, a ceremony anciently used in the conferring of knighthood.

Antiquaries are not agreed wherein the accolade properly consisted. The generality suppose it to be the embrace, or kiss, which princes anciently gave the new knight, as a token of their affection: whence the word *accolade*; q. d. a clasping, or taking round the neck. Others will rather have it to be a blow on the chine of the neck, given on the same occasion. The Accolade is of some antiquity, in whichsoever of the two senses it be taken. Greg. de Tours writes, that the kings of France, even of the first race, in conferring the gilt shoulder belt, kissed the knights on the left cheek. For the *accolée*, or blow, John of Salisbury assures us, it was in use among the ancient Normans: by this it was that William the Conqueror conferred the honour of knighthood on his son Henry. At first it was given with the naked fist; but was afterwards changed into a blow with the flat of the sword on the shoulder of the knight.

ACCOLE/E, sometimes synonymous with **ACCOLADE**, which see.—It is also used in various senses in heraldry; sometimes it is applied to two things joined; at other times, to animals with crowns or collars about their necks, as the lion in the Ogilvy's arms; and, lastly, to kews, battons, maces, swords, &c. placed saltier-wise behind the shield.

ACCOLTI, BENEDICT, the younger, grandson of Benedict Accolti the elder, who flourished about the year 1376, was born at Arezzo in 1415. About the year 1450, he was appointed secretary to the republic of Florence, when he was greatly distinguished. He wrote "Four Books concerning the War which the Christians carried on against the infidels to recover Judæa and the Holy Sepulchre." This work was printed at Venice in 1532, and it is the ground-plot of Tasso's *Jerusalem Delivered*. He wrote also an account of the "Excellent Personages of his Time," in the form of dialogue. He died in 1466.

ACCOLTI, Benedict, was nephew, or according to some, grandson of Peter Accolti, and was born at Florence in 1497. He was much distinguished for his knowledge of law, and a most retentive memory; and was such a master of the Latin language, that he obtained the flattering appellation of *the Cicero of the age*. He enjoyed very high ecclesiastical honours: Leo X. bestowed on him the bishopric of Cadiz; Adrian the VI. gave him that of Cremona, and the archbishopric of Ravenna; and Clement VII. raised him to the rank of cardinal. At the request of Clement, he wrote a treatise in vindication of the pope's right to the kingdom of Naples. He left several other works, and particularly some pieces of poetry. He died at Florence in 1549.

ACCOLTI, Francis, brother of the former, was born about the year 1418. He was professor of jurispru-

dence in several universities, and was styled the *prince of lawyers*. His understanding was vigorous, his knowledge was extensive, and his eloquence powerful; but he was so sordidly parsimonious that he amassed immense treasures. He died about the year 1470; and left behind him several works on law, and some translations of the works of Chrysostom.

ACCOLTI, Peter, the son of Benedict the younger, was born at Arezzo about the year 1455. He was a professor of law, and taught with great reputation. He was successively raised to several bishoprics, and at last to the rank of cardinal in 1511. He was created by Pope Leo X. prince of the state of Nepi. He wrote a comedy entitled "Virginia," and some other poems which were much applauded by his contemporaries. He died at Rome in 1532.

ACCOMMODATION, the application of one thing, by analogy, to another; or the making two or more things agree with one another.

To know a thing by *accommodation*, is to know it by the idea of a similar thing referred thereto.

A prophecy of scripture is said to be fulfilled various ways; properly, as when a thing foretold comes to pass; and improperly, or by way of *accommodation*, when an event happens to any place or people, like to what fell out some time before to another.—Thus, the words of Isaiah, spoken to those of his own time, are said to be fulfilled in those who lived in our Saviour's; and are *accommodated* to them: "Ye hypocrites, well did Esaias prophesy of you," &c. which same words St Paul afterwards *accommodates* to the Jews of his time.

The primitive church *accommodated* multitudes of Jewish, and even heathen ceremonies and practices, to Christian purposes; but the Jews had before done the same by the Gentiles: some will even have circumcision, the tabernacle, brazen serpent, &c. to have been originally of Egyptian use, and only *accommodated* by Moses to the purposes of Judaism*. Spencer main-^{* Saurin.} tains, that most of the rites of the old law were in imitation of those of the Gentiles, and particularly of the Egyptians; that God, in order to divert the children of Israel from the worship they paid to their false deities, consecrated the greatest part of the ceremonies performed by those idolaters, and had formed out of them a body of the ceremonial law; that he had indeed made some alterations therein, as barriers against idolatry; and that he thus *accommodated* his worship to the genius and occasions of his ancient people. To this con-^{Dis. O. T. tom. i.} descension of God, according to Spencer †, is owing the † *De legib.* origin of the tabernacle, and particularly that of the *Hebr. diss. i.* ark. These opinions, however, have been controverted^{3. p. 32.} by later writers.

ACCOMPANIMENT, something attending or added as a circumstance to another, either by way of ornament, or for the sake of symmetry.

ACCOMPANIMENT, ACCOMPAGNAMENTO, ACCOMPAGNATURA, in *Music*, denotes the instruments which accompany a voice, in order to sustain it, as well as to make the music more full. The accompaniment is used in recitative, as well as in song; on the stage, as well as in the choir, &c. The ancients had likewise their accompaniments in the theatre; they had even different kinds of instruments to accompany the chorus, from those which accompanied the actors in the recitation.

The

Accolti
||
Accompaniment.

Accompa-
niment
||
Accords.

The accompaniment, among the moderns, is frequently a different part or melody from the song it accompanies. It is disputed whether it was so among the ancients. It is generally alleged, that their accompaniments went no farther than the playing in octave, or in antiphony to the voice. The Abbé Fraguier, from a passage in Plato, pretends to prove, that they had actual symphony, or music in parts: but his arguments seem far from being conclusive.

ACCOMPANIMENT, in *Painting*, denotes such objects as are added, either by way of ornament or fitness to the principal figures; as dogs, guns, game, &c. in a hunting piece.

ACCOMPANIMENT, in *Heraldry*, any thing added to a shield by way of ornament; as the belt, mantling, supporters, &c. It is also applied to several bearings about a principal one; as a saltier, bend, fess, chevron, &c.

ACCOMPLICE, one that has a hand in a business; or is privy in the same design or crime with another. See ACCESSORY.

By the law of Scotland, the *accomplice* can only be prosecuted after the conviction of the *principal* offender, unless the accession of the *accomplice* is immediate, in *ipso actu*, (so as in effect to render them *co-principal*). By the general rule, the *accomplice* suffers the same punishment with the *principal* offender; yet if he be remarkably less guilty, justice will not permit equal punishment.

The council of Sens, and several other synodical statutes, expressly prohibit the revealing of *accomplices*.

ACCOMPLISHMENT, the entire execution or fulfilling of any thing.

ACCOMPLISHMENT is principally used in speaking of events foretold by the Jewish prophets in the Old Testament, and fulfilled under the New. We say a literal accomplishment, a mystical or spiritual accomplishment, a single accomplishment, a double accomplishment, a Jewish accomplishment, a Christian, a heathen accomplishment. The same prophecy is sometimes accomplished in all, or in several of those different ways. Thus, of some of the prophecies of the Old Testament, the Jews find a literal accomplishment in their own history, about the time when the prophecy was given: the Christians find another in Christ, or the earliest days of the church; the heathens another, in some of their emperors; the Mahometans another, in their legislator, &c. There are two principal ways of accomplishing a prophecy, *directly*, and by *accommodation*. See ACCOMMODATION, and PROPHECY.

ACCOMPLISHMENT, is also used for any mental or personal endowment.

ACCORD, in *Painting*, is the harmony that reigns among the lights and shades of a picture.

ACCORDS, STEPHEN TABOUROT, SEIGNEUR DES, advocate in the parliament of DIJON in France, and king's advocate in the bailiwick and chancery of that city, was born in 1549. He was a man of genius and learning; but too much addicted to trifles, as appears from his piece entitled, "Les Bigarrures," printed at Paris in 1582. This was not his first production, for he had before printed some sonnets. His work entitled *Les Touches*, was published at Paris in 1585; which is indeed a collection of witty poems, but worked up in

a loose manner, according to the licentious taste of that age. His Bigarrures are written in the same strain. He was censured for this way of writing, which obliged him to publish an apology. The lordship of Accords is an imaginary fief, or title from the device of his ancestors, which was a drum, with the motto *à tous accords*, "chiming with all." He had sent a sonnet to a daughter of M. Begat, the great and learned president of Burgundy, "who (says he) did me the honour to love me: And inasmuch (continues he), I had subscribed my sonnet with only my device *à tous accords*, this lady first nicknamed me, in her answer, *Seigneur des Accords*; by which title her father also called me several times. For this reason I chose this surname, not only in all my writings composed at that time, but even in these books." He died in 1595, in the 46th year of his age.

ACCORSO (in Latin *Accursius*), FRANCIS, the elder, an eminent lawyer, was born at Bagnolo, near Florence, in 1182. He began the study of law at a late period of life; but such were his assiduity and proficiency, that he soon distinguished himself. He was appointed professor at Bologna, and became a very eminent teacher. He undertook the great work of uniting and arranging into one body the almost endless comments and remarks upon the Code, the Institutes, and Digests, which, he observed, only tended to involve the subjects in obscurity and contradiction. When he was employed in this work, it is said, that hearing of a similar one proposed and begun by Odo-fred, another lawyer of Bologna, he feigned indisposition, interrupted his public lectures, and shut himself up, till he had, with the utmost expedition, accomplished his design. His work, entitled "A Perpetual Commentary," was much esteemed. It was printed with the "Body of Law," published at Lyons in 1627. He died in 1260, and left very great riches. His son, the younger Francis Accorso, succeeded him in his professorship, and accompanied Edward I. to England, on his return from the crusade in 1237. (*Gen. Biog.*).

ACCORSO, *Mariangelo*, a learned and ingenious critic, was a native of Aquila, in the kingdom of Naples, and lived about the beginning of the sixteenth century. To a perfect knowledge of Greek and Latin, he added an intimate acquaintance with several modern languages. Classical literature was much improved and promoted by his labours. In discovering and collating ancient manuscripts he displayed uncommon assiduity and diligence. His work, entitled "*Diatribæ*," printed at Rome, in folio, in 1524, is a singular monument of erudition and critical skill. He bestowed, it is said, unusual pains on Claudian, and made above seven hundred corrections in the works of that poet, from different manuscripts. Unfortunately the world has been deprived of the advantage of these criticisms; for they were never published. These corrections were made while he travelled on horseback during a tour through Germany, a circumstance which is strongly characteristic of his industry and assiduity. An edition of *Ammianus Marcellinus*, which he published at Augsburg in 1533, contains five books more than any former one. He was the first editor of the "Letters of Cassiodorus," with his "Treatise on the Soul." The affected

Accords,
Accorso.

Accorso
||
Accretion.

use of antiquated terms introduced by some of the Latin writers of that age, is humorously ridiculed in a dialogue published in 1531, entitled, "*Osco, Volusco, Romanoque, Eloquentia, Interlocutoribus, Dialogus Ludis Romanis actus*." He composed a book on the invention of printing. On the first leaf of a grammar of Donatus, printed on vellum, there is written with his own hand: "This Donatus, with another book entitled *Confessionalia*," were the first books printed; and John Faustus, citizen of Mentz, inventor of the art, had put them to the press in the year 1450." He had been accused of plagiarism in his notes on Ausonius; and the solemn and determined manner in which he repelled this charge of literary theft, presents us with a singular instance of his anxiety and care to preserve his literary reputation unstained and pure. It is in the following oath: "In the name of gods and men, of truth and sincerity, I solemnly swear, and if any declaration be more binding than an oath, I in that form declare, and I desire that my declaration may be received as strictly true, that I have never read or seen any author, from which my own lucubrations have received the smallest assistance or improvement; nay, that I have even laboured, as far as possible, whenever any writer has published any observations which I myself had before made, immediately to blot them out of my own works. If in this declaration I am forsworn, may the pope punish my perjury; and may an evil genius attend my writings, so that whatever in them is good, or at least tolerable, may appear to the unskilful multitude exceedingly bad, and even to the learned trivial and contemptible; and may the small reputation I now possess be given to the winds, and regarded as the worthless boon of vulgar levity." (*Gen. Biog.*)

ACCOUNT, or **ACCOMPT**, in a general sense, a computation or reckoning of any thing by numbers.—Collectively it is used to express the books which merchants, traders, bankers, &c. use for recording their transactions in business. See **BOOK-KEEPING**.

Chamber of Accounts, in the French polity, a sovereign court of great antiquity, which took cognizance of and registered the accounts of the king's revenue; nearly the same with the English *Court of Exchequer*.

ACCOUNT is taken sometimes, in a particular sense, for the computation of time: thus we say, the Julian account, the Gregorian account, &c. in which sense it is equivalent to *style*.

ACCOUNTANT, or **ACCOMPTANT**, in the most general sense, is a person skilled in accounts. In a more restricted sense, it is applied to a person, or officer, appointed to keep the accounts of a public company or office: as the South Sea, the India Company, the Bank, the Excise, &c.

ACCOUNTANTSHIP, the art of keeping and balancing accounts. See **BOOK-KEEPING**.

ACCOUNTANT-GENERAL, a new officer in the court of chancery, appointed by act of parliament to receive all moneys lodged in court instead of the masters, and convey the same to the bank of England for security.

ACCOUREMENT, an old term applied to the furniture of a soldier, knight, or gentleman.

ACCRETION, in *Physics*, the increase or growth of an organical body, by the accession of new parts.

See **NUTRITION**, **PLANTS**, and **VEGETABLES**.

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+

Accretion
||
Accursed.

ACCRETION, among civilians, the property acquired in a vague or unoccupied thing, by its adhering to or following another already occupied: thus, if a legacy be left to two persons, one of whom dies before the testator, the legacy devolves to the survivor by right of accretion.

ACCROCHE, in *Heraldry*, denotes a thing's being hooked with another.

ACCUBATION, a posture of the body, between sitting and lying. The word comes from the Latin *accubare*, compounded of *ad*, to, and *cubo*, I lie down. *Accubation*, or *Accubitus*, was the table posture of the Greeks and Romans; whence we find the words particularly used for the lying, or rather (as we call it) sitting down to meat. The Greeks introduced this posture. The Romans, during the frugal ages of the republic, were strangers to it; but as luxury got footing, this posture came to be adopted, at least by the men; for as to women, it was reputed an indecency in them to lie down among the men: though, afterwards, this too was got over. Children did not lie down, nor servants, nor soldiers, nor persons of meaner condition. They took their meals sitting, as a posture less indulgent. The Roman manner of disposing themselves at table was this: A low round table was placed in the *cenaculum*, or dining room, and about this, usually three, sometimes only two, beds or couches; and according to their number, it was called *biclinium* or *triclinium*. These were covered with a sort of bedclothes, richer or plainer according to the quality of the person, and furnished with quilts and pillows, that the guests might lie the more commodiously. There were usually three persons on each bed; to crowd more, was esteemed sordid. In eating, they lay down on their left sides, with their heads resting on the pillows, or rather on their elbows. The first lay at the head of the bed, with his feet extended behind the back of the second; the second lay with the back of his head towards the navel of the first, only separated by a pillow, his feet behind the back of the third; and so of the third or fourth. The middle place was esteemed the most honourable. Before they came to table, they changed their clothes, putting on what they called *cenatoria vestis*, the dining garment; and pulled off their shoes, to prevent soiling the couch.

ACCUBITOR, an ancient officer of the emperors of Constantinople, whose business was to lie near the emperor. He was the head of the youth of the bed-chamber, and had the *cubicularius* and *procurator* under him.

ACCUMULATION, in a general sense, the act of heaping or amassing things together. Among lawyers, it is used in speaking of the concurrence of several titles to the same thing, or of several circumstances to the same proof.

Accumulation of Degrees, in a university, is the taking several of them together, or at shorter intervals than usual, or than is allowed by the rules of the university.

ACCURSED, something that lies under a curse, or sentence of excommunication.

In the Jewish idiom, *accursed* and *crucified* were synonymous. Among them, every one was accounted *accursed* who died on a tree. This serves to explain the difficult passage in Rom. ix. 3. where the apostle Paul

R

Paul

Accused ||
Accusative. Paul wished himself *accursed* after the manner of Christ, i. c. crucified, if happily he might by such a death save his countrymen. The proposition *apo* here made use of, is used in the same sense, 2 Tim. i. 3. where it obviously signifies *after the manner of*.

ACCUSATION, the charging any person with a criminal action, either in one's own name, or in that of the public. The word is compounded of *ad*, to; and *causari* to plead.

Writers on politics treat of the benefit and the inconveniences of public accusations. Various arguments are alleged, both for the encouragement and discouragement of accusations against great men. Nothing, according to Machiavel, tends more to the preservation of a state, than frequent accusations of persons trusted with the administration of public affairs. This, accordingly, was strictly observed by the Romans, in the instances of Camillus, accused of corruption by Manlius Capitolinus, &c. Accusations, however, in the judgment of the same author, are not more beneficial than calumnies are pernicious; which is also confirmed by the practice of the Romans. Manlius not being able to make good his charge against Camillus, was cast into prison.

By the Roman law, there was no public accuser for public crimes; every private person, whether interested in the crime or not, might accuse, and prosecute the accused to punishment or absolution. Cato, the most innocent person of his age, had been accused 42 times, and as often absolved. But the accusation of *private* crimes was never received but from the mouths of those who were immediately interested in them: None (*e. g.*) but the husband could accuse his wife of adultery.

The ancient Roman lawyers distinguished between *postulatio*, *delatio*, and *accusatio*. For, first, leave was desired to bring a charge against one, which was called *postulare*: then he against whom the charge was laid was brought before the judge; which was called *deferre*, or *nomini delatio*: lastly, the charge was drawn up and presented; which was properly the *accusatio*. The accusation properly commenced, according to Poetianus, when the *reus* or party charged, being interrogated, denied he was guilty of the crime, and subscribed his name to the *delatio* made by his opponent.

In the French law, none but the procureur general, or his deputies, can form an accusation, except for high treason and coining, where accusation is open to every body. In other crimes, private persons can only act the part of denouncers, and demand reparation for the offence, with damages.

In Britain, by Magna Charta, no man shall be imprisoned or condemned on any accusation, without trial by his peers, or the law; none shall be vexed with any accusation, but according to the law of the land; and no man may be molested by petition to the king, &c. unless it be by indictment or presentment of lawful men, or by process at common law. Promoters of suggestions, are to find surety to pursue them; and if they do not make them good, shall pay damages to the party accused, and also a fine to the king. No person is obliged to answer upon oath to a question whereby he may accuse himself of any crime.

ACCUSATIVE, in *Latin Grammar*, is the fourth

case of nouns, and signifies the relation of the noun on which the action implied in the verb terminates; and hence, in such languages as have cases, these nouns have a particular termination, called *accusative*, as, *Augustus vicit Antonium*, Augustus vanquished Antony. Here *Antonium* is the noun on which the action implied in the word *vicit* terminates; and, therefore, must have the accusative termination. Ovid, speaking of the palace of the sun, says, *Materiem superabat opus*, The work surpassed the materials. Here *materiem* has the accusative termination; because it determines the action of the verb *superabat*.—In the English language there are no cases, except the genitive; the relation of the noun being shown by the assistance of prepositions, as *of*, *to*, *from*, &c.

ACCUSIORUM COLONIA, in *Ancient Geography*, an inland town in the Cavares, in Gallia Narbonensis; now *Grenoble*, in Dauphiné. See GRENOBLE.

ACE, among gamesters, a card or die marked only with one point.

ACELDAMA, in Scripture history, a place without the south wall of Jerusalem, beyond the brook of Siloam, was called the Potters field, because clay of which pots were made was dug out of it. It was afterwards bought with the money with which the high priests and rulers of the Jews purchased the blood of Jesus Christ, and hence it was called *Aceldama*, the field of blood.

ACELUM, or ACELIUM, in *Ancient Geography*, a town of the Venetian territory, now called *Azolo*, situated to the west of Trevigi, at the source of the rivulet Musone. E. Long. 13°. N. Lat. 45°.

ACENTETUM, or ACANTETA, in *Natural History*, a name given by the ancients to the purest and finest kind of rock crystal: They used the crystal in many ways; sometimes engraving on it, and sometimes forming it into vases and cups, which were held next in value to the *vasa murrhina* of those times. The crystal they obtained from the island of Cyprus was much esteemed; but often faulty in particular parts, having hairs, cracks, and fonnnesses, which they called *salts*, in the middle of the large pieces. Pliny tells us, that when it was used for engraving on, the artist could conceal all these blemishes among the strokes of his work; but when it was to be formed into cups or precious vases, they always chose the acentetum which had no flaws or blemishes.

ACEPHALI, or ACEPHALITÆ, a term applied to several sects who refused to follow some noted leader. Thus the persons who refused to follow either John of Antioch, or St Cyril, in a dispute that happened in the council of Ephesus, were termed *Acephali*, without a head or leader. Such bishops, also, as were exempt from the jurisdiction and discipline of their patriarch, were styled *Acephali*.

ACEPHALI, the levellers in the reign of King Henry I. who acknowledged no head or superior. They were reckoned so poor, that they had not a tenement by which they might acknowledge a superior lord.

ACEPHALOUS, or ACEPHALUS, in a general sense; without a head.

The term is more particularly used in speaking of certain nations, or people, represented by ancient naturalists and cosmographers, as well as by some modern travellers,

Accusative ||
Acephalous.

Acephalous travellers, as formed without heads; their eyes, mouth, &c. being placed in other parts.

Acerra. Such are the Blemmyes, a nation of Africa near the head of the Niger, represented to be by Pliny and Solinus; *Blemmyes traduntur capita abesse, ore et oculis pectore affixis*. Ctesias and Solinus mention others in India near the Ganges, *sine cervice, oculos in humeris habentes*. Mela also speaks of people, *quibus capita et vultus in pectore sunt*. And Suidas, Stephanus Byzantinus, Vopiscus, and others after them, relate the like. Some modern travellers still pretend to find acephalous people in America.

Several opinions have been framed as to the origin of the fable of the Acephali. The first is that of Thomas Bartholin, who turns the whole into a metaphor; being convinced, that the name Acephali was anciently given to such as had less brain, or conducted themselves less by the rules of prudence than others. Olearius rather apprehends, that the ancient voyagers, viewing certain barbarous people from the coasts, had been imposed on by their uncouth dress; for that the Samogitians, being short of stature, and going in the severity of winter with their heads covered in hoods, seem at a distance as if they were headless. F. Lafitau says, that by Acephali are only meant people whose heads are sunk below their shoulders. In effect, Hulsius, in his epitome of Sir Walter Raleigh's voyage to Guiana, also speaks of a people which that traveller found in the province of Irvipanama, between the lakes of Panama and Cassipa, who had no head or neck; and Hondius, in his map, marks the place with the figures of these monsters. Yet De Laet * rejects the story; being informed by others, that the inhabitants of the banks of the Caora, a river that flows out of the lake of Cassipa, have their heads so far sunk between their shoulders, that many believed they had their eyes in their shoulders, and their mouths in their breasts.

But though the existence of a nation of Acephali be ill warranted, naturalists furnish several instances of individuals born without heads, by some lusus or deviation of nature. Wepfer gives † a catalogue of such acephalous births, from Schenckius, Licetus, Paræus, Wolfius, Mauriceau, &c.

ACEPHALUS, an obsolete term for the tænia or tape-worm, which was long supposed to be acephalous. The first who gave it a head was Tulpus: and after him, Febr: The former even makes it *biceps*, or two-headed.

ACEPHALUS, is also used to express a verse defective in the beginning.

ACER, the MAPLE, or SYCAMORE TREE. See **BOTANY Index**.

ACERB, a sour rough astringency of taste, such as that of unripe fruit.

ACERINA, in *Ichthyology*, a name given by Pliny and other of the old naturalists, to the fish we at this time call the *ruffe*. See **PERCA**, **ICHTHYOLOGY Index**.

ACERNO, in *Geography*, a town of Italy, in the citorior principality of Naples, with a bishop's see. It is situated 12 miles north-east of Saluno, in E. Long. 15. 46. N. Lat. 40. 45.

ACERRA, in antiquity, an altar erected among the Romans, near the bed of a person deceased, on which his friends daily offered incense till his burial.—

The real intention probably was to overcome any offensive smell that might arise about the corpse. The Chinese have still a custom like this: they erect an altar to the deceased in a room hung with mourning; and place an image of the dead person on the altar, to which every one that approaches it bows four times, and offers oblations and perfumes.

The *acerra* also signified a little pot wherein were put the incense and perfumes to be burnt on the altars of the gods and before the dead. It appears to have been the same with what was otherwise called *thuribulum*, and *pyxis*.

We find mention of *acerræ* in the ancient church. The Jews had also their *acerræ*, in our version rendered *censers*; and the Romanists still retain them under the name of *incense pots*. In Roman writers, we frequently meet with *plena acerra*, a full acerra: to understand which, it is to be observed, that people were obliged to offer incense in proportion to their estate and condition; the rich in larger quantities, the poor only a few grains; the former poured out full *acerræ* on the altar, the latter took out two or three bits with their fingers.

ACERRA, a town of Italy, in the kingdom of Naples, and in the Terra di Lavoro; seated on the river Agno, seven miles north-east of Naples. E. Long. 14. 30. N. Lat. 40. 55.

ACERRÆ, in *Ancient Geography*, the name of a town on the Clanus, in Campania, not far from Naples; now **ACERRA**.—The name also of another town, now called *la Girola*, in the territory and to the south-east of Lodi, where the rivulet Serio falls into the Adda, to the west of Cremona and north of Placentia.

ACESINES, in *Ancient Geography*, a large and rapid river of India which Alexander passed in his expedition into that country. The kingdom of Porus, which was conquered by Alexander, lay between the Hydaspes and this river, which, uniting with the former and other considerable rivers, pours its waters into the Indus. According to Major Rennell, the modern Jenaub is the Acesines of the ancients.

ACESIUS, a bishop of Constantinople in the reign of Constantine, was a rigid adherent to the Novatian doctrines, according to which those whom persecutions had shaken from the faith, or who were guilty of any mortal sin after baptism, could not be admitted to the communion of the church, even after exhibiting the most convincing proofs of sincere repentance. Constantine, who was extremely displeased with the severity of this rigid sect, in discouraging and rejecting repentance, is said to have thus expressed himself: "Then, Acesius, make a ladder for yourself, and go up to heaven alone." (*Gen. Biog.*)

ACESCENT, a word used to denote any thing which is turning sour, or which is slightly acid. It is only applied properly to the former of these two meanings. The second may be expressed by either of the two words, *acidulous* or *sub-acid*.

ACETABULUM, in antiquity, a measure used by the ancients, equal to one-eighth of our pint. It seems to have acquired its name from a vessel in which acetum or vinegar was brought to their tables, and which probably contained about this quantity.

ACETABULUM, in *Anatomy*, a cavity in any bone for

Acetabulum
||
Achaëans.

for receiving the protuberant head of another, and thereby forming that species of articulation called ENARTHROSIS.

ACETABULUM, in *Botany*, the trivial name of a species of the peziza, or cup peziza, a genus belonging to the cryptogamia fungi of Linnæus. It has got the name of *acetabulum*, from the resemblance its leaves bear to a cup. See PEZIZA, *BOTANY Index*.

ACETARY. Grew, in his anatomy of plants, applies this term to a pulpy substance, in certain fruits, e. g. the pear, which is enclosed in a congeries of small calcenous bodies towards the base of the fruit, and is always of an acid taste.

ACETOSA, *SORREL*; by Linnæus joined to the genus *Rumex*. See *BOTANY Index*.

ACETOSELLA, in *Botany*, a species of *OXALIS*. See *BOTANY Index*.

ACETOUS, an epithet applied to such substances as are sour, or partake of the nature of vinegar.

ACETUM, VINEGAR, the vegetable ACID of the chemists. See ACETOUS ACID, *CHEMISTRY Index*.

ACHABYTUS, in *Ancient Geography*, a high mountain in Rhodes, on the top of which stood a temple of Jupiter.

ACHÆA, in *Ancient Geography*, a town of the island of Rhodes, in the district of Jalytus, and the first and most ancient of all, said to be built by the Heliades, or grandsons of the sun.

ACHÆA, a hamlet of Asiatic Sarmatia, on the Euxine. The inhabitants were called *Achæi*, a colony of the Orchomenians.

ACHÆANS, the inhabitants of ACHAIA Propria, a Peloponnesian state. This republic was not considerable, in early times, for the number of its troops, nor for its wealth, nor for the extent of its territories; but it was famed for its probity, its justice, and its love of liberty. Its high reputation for these virtues was very ancient. The Crotonians and Sybarites, to re-establish order in their towns, adopted the laws and customs of the Achæans. After the famous battle of Leuctra, a difference arose betwixt the Lacedæmonians and Thebans, who held the virtue of this people in such veneration, that they terminated the dispute by their decision. The government of the Achæans was democratical. They preserved their liberty till the time of Philip and Alexander: But in the reign of these princes, and afterwards, they were either subject to the Macedonians, who had made themselves masters of Greece, or oppressed by cruel tyrants. The Achæan commonwealth consisted of twelve inconsiderable towns in Peloponnesus. Its first annals are not marked by any great action, for they are not graced with one eminent character. After the death of Alexander, this little republic was a prey to all the evils which flow from political discord. Zeal for the good of the community was now extinguished. Each town was only attentive to its private interest. There was no longer any stability in the state; for it changed its masters with every revolution in Macedonia. Towards the 124th Olympiad, about the time when Ptolemy Soter died, and when Pyrrhus invaded Italy, the republic of the Achæans recovered its old institutions and unanimity. The inhabitants of Patræ and of Dymæ were the first assertors of ancient liberty. The tyrants were banished, and the towns again made one commonwealth.

A public council was then held, in which affairs of importance were discussed and determined. A register was appointed to record the transactions of the council. This assembly had two presidents, who were nominated alternately by the different towns. But instead of two presidents, they soon elected but one. Many neighbouring towns which admired the constitution of this republic, founded on equality, liberty, the love of justice, and of the public good, were incorporated with the Achæans, and admitted to the full enjoyment of their laws and privileges.—The arms which the Achæans chiefly used were slings. They were trained to the art from their infancy, by slinging from a great distance, at a circular mark of a moderate circumference. By long practice they took so nice an aim, that they were sure, not only to hit their enemies on the head, but on any part of the face they chose. Their slings were of a different kind from those of the Balearians, whom they far surpassed in dexterity.

ACHÆI, ACHÆANS, the inhabitants of Achaia Propria. In Livy, the people of Greece; for the most part called *Achivi*, by the Roman poets. In Homer, the general name for Grecians. See ACHEANS.

ACHÆORUM PORTUS, (Pliny); now *Portu Buon*, a harbour of the Chersonesus Taurica, on the Euxine: Another near Sigæum, into which the Xanthus, after being joined by the Simois, falls.

ACHÆMENES, according to Herodotus, was grandfather of Cambyses, and great-grandfather of Cyrus the first, king of Persia. Most of the commentators of Horace are of opinion, that the Achæmenes whom that poet mentions, ode xii. of his 2d book, was one of the Persian monarchs; but, if that were true, he must have reigned before the Medes subdued the Persians; for we do not hear of any king of that name from the time that the Persians founded that great monarchy, which is looked upon as the second universal one. However this be, the epithet *Achæmenians* is frequently given to the Persians, in the old Latin poets.

ACHÆMENES, son of Darius I. king of Persia, and brother of Xerxes, had the government of Egypt bestowed on him, after Xerxes had forced the Egyptians to return to their allegiance. He some time after commanded the Egyptian fleet in the celebrated expedition which proved so fatal to all Greece. The Egyptians having again taken up arms after the death of Xerxes, Achæmenes was sent into Egypt to suppress the rebellion; but was vanquished by Inarus, chief of the rebels, succoured by the Athenians.

ACHÆUS, cousin-german to Seleucus Ceraunus and Antiochus the Great, kings of Syria, became a very powerful monarch, and enjoyed the dominions he had usurped for many years; but at last he was punished for his usurpations in a dreadful manner, in the 140th year of Rome, as related by Polybius*.

ACHAIA, a name taken for that part of Greece which Ptolemy calls *Hellas*; the younger Pliny, *Græcia*; now called *Livadia*: bounded on the north by Thessaly, the river Sperchius, the Sinus Maliacus, and Mount Oëta; on the west by the river Achelous; on the east, turning a little to the north, it is washed by the Archipelago, down to the promontory of Sunium; on the south, joined to Peloponnesus, or the Morea, by the isthmus of Corinth, five miles broad.

Achaëans
||
Achaia.

* Lib. viii.
cap. 56.

ACHAIA Propria, anciently a small district in the north of Peloponnesus, running westward along the bay of Corinth, and bounded on the west by the Ionian sea, on the south by Elis and Arcadia, and on the east by Sicyonia: inhabitants the *Achaean*s, properly so called; its metropolis *Patrae*. It is now called *Romania Alta*, in the Morea.

ACHAIA was also taken for all those countries that joined in the Achaean league, reduced by the Romans to a province. Likewise for Peloponnesus.

ACHAIE Presbyteri, or the Presbyters of Achaia, were those who were present at the martyrdom of St Andrew the apostle, A. D. 59; and are said to have written an epistle in relation to it. Bellarmin, and several other eminent writers in the church of Rome, allow it to be genuine; while Du Pin, and some others, expressly reject it.

ACHAIUS, son of Ethwin, was raised to the crown of Scotland, A. D. 788. The emperor Charlemagne sent an embassy to this prince, to request an alliance with him against the English, whose pirates so infested the seas, that the merchants could not carry on their trade. The alliance was concluded in France, upon conditions so advantageous to the Scots, that Achaius, to perpetuate the memory of it, added to the arms of Scotland a double field sowed with lilies. He died in 819.

ACHALALACTLI, a species of king's-fisher. See *ALCEDO*, *ORNITHOLOGY Index*.

ACHAN, the son of Carmi, of the tribe of Judah, at the taking of Jericho, concealed two hundred shekels of silver, a Babylonish garment, and a wedge of gold, contrary to the express command of God. This sin proved fatal to the Israelites, who were repulsed at the siege of Ai. In this dreadful exigence, Joshua prostrated himself before the Lord, and begged that he would have mercy upon his people. Achan was discovered by casting lots, and he and his children were stoned to death. This expiation being made, Ai was taken by stratagem. Josh. vii. 8, 9.

ACHANE, an ancient Persian corn measure, containing 45 Attic medimni.

ACHARACA, anciently a town of Lydia, situated between Tralles and Nysa; in which were the temple of Pluto and the cave Charonium, where patients slept in order to obtain a cure.

ACHAT, in *Law*, implies a purchase or bargain. And hence probably purveyors were called *achators*, from their making bargains.

ACHATES, the companion of Æneas, and his most faithful friend, celebrated in Virgil.

ACHATES, in *Natural History*, the same as *AGATE*.

ACHATES, in *Ancient Geography*, a river of Sicily, now the *Drillo*; which runs from north to south, almost parallel with, and at no great distance from, the Gela; and rises in the north of the territory of Noto. It gave name to the achates, or agate, said to be first found there.

ACHAZIB, or *ACHZIB*, in *Ancient Geography*, a town of Galilee, in the tribe of Asher, nine miles from Ptolemais.—Also a town in the more southern parts of the tribe of Judah.

ACHEEN, *ACHE'*, or *ACHEN*, a kingdom of Sumatra in the East Indies, situated in the north-western part of the island.

The capital is situated on a river which empties itself near the north-west point, or Acheen head, about two miles from the mouth. It lies in a wide valley, formed like an amphitheatre by two lofty ranges of hills. The river is not large, and by emptying itself in several channels is rendered very shallow at the bar. In the dry monsoon, it will not admit boats of any burthen, much less large vessels, which lie without, in the road formed by the islands off the point. Though no longer the great mart of eastern commodities, it still carries on a considerable trade with the natives of that part of the coast of Indostan called *Tellinga*, who supply it with the cotton goods of their country, and receive in return, gold dust, sapan wood, betel nut, patch-leaf, a little pepper, sulphur, camphire, and benzoin. The country is supplied with Bengal opium, and also with iron, and many other articles of merchandise, by the European traders.

Acheen is esteemed comparatively healthy, being more free from woods and swamps than most other portions of the island; and the fevers and dysenteries to which these are supposed to give occasion, are there said to be uncommon. The soil is light and fertile; and the products, beside those already enumerated as articles of export trade, and a variety of fine fruits, are chiefly rice and cotton. There is likewise some raw silk procured in the country, of very inferior quality. Gold dust is collected in the mountains near Acheen, but the greatest part is brought from the southern ports of Nalaboo and Soosoo. The sulphur is gathered from a volcanic mountain in the neighbourhood, which supplies their own consumption for the manufacture of gunpowder, and admits of a large exportation.

In their persons, the Achenese differ from the rest of the Sumatrans, being taller, stouter, and darker complexioned. They appear not to be a genuine people; but are thought, with great appearance of reason, to be a mixture of Battas, Malays, and Moors from the west of India. In their dispositions they are more active and industrious than their neighbours: they possess more penetration and sagacity; have more general knowledge; and, as merchants, they deal upon a more extensive and liberal footing. Their religion is Mahometanism; and having a great number of mosques and priests, its forms and ceremonies are strictly observed.

The appearance of the town, and the nature of the buildings, are much the same as are found in the generality of Malay bazars, excepting that the superior wealth of this place has occasioned a great number of public edifices, but without the smallest pretensions to magnificence. The king's palace, if it deserves the appellation, is a very rude and uncouth piece of architecture, designed to resist the force of an enemy, and surrounded for that purpose by strong walls, but without any regular plan, or view to the modern system of military attack. The houses in common are built of bamboos and rough timber, and raised some feet from the ground on account of the place being overflowed in the rainy season.

A considerable fabric of a thick species of cotton cloth, and of stuff for the short drawers worn both by Malays and Achenese, is established here, and supplies an extensive demand. They weave also very handsome silk pieces of a particular form, for that part of the dress which is called by the Malays *cayen serrang*.

Acheen.

The

Acheen.

The Achenese are expert and bold navigators, and employ a variety of vessels, according to the voyages they undertake, and the purposes for which they design them. The river is covered with a multitude of fishing sampans or canoes, which go to sea with the morning breeze, and return in the afternoon, with the sea wind, fully laden.

Having no convenient coins, though most species of money will be taken here at a valuation, they commonly make their payments in gold dust, and for that purpose are all provided with scales or small steelyards. They carry their gold about them, wrapped up in pieces of bladder, and often purchase to so small an amount, as to make use of grains or seeds for weights.

The monarchy is hereditary; and the king usually maintains a guard of 100 sepoys about his palace.

According to Mr Marsden, "the grand council of the nation consists of the king or *sultan*, four *ooloballangs*, and eight of a lower degree, who sit on his right hand, and sixteen *cajoorangs*, who sit on his left. At the king's feet sits a woman, to whom he makes known his pleasure: by her it is communicated to an eunuch, who sits next to her; and by him to an officer named *cajoorang gondong*, who then proclaims it aloud to the assembly. There are also present two other officers, one of whom has the government of the *bazar* or market, and the other the superintending and carrying into execution the punishment of criminals. All matters relative to commerce and the customs of the port come under the jurisdiction of the *shabandar*, who performs the ceremony of giving the *chap* or license for trade; which is done by lifting a golden-hafted creese over the head of the merchant who arrives, and without which he dares not to land his goods. Presents, the value of which are become pretty regularly ascertained, are then sent to the king and his officers. If the stranger be in the style of an ambassador, the royal elephants are sent down to carry him and his letters to the monarch's presence; these being first delivered into the hands of an eunuch, who places them in a silver dish, covered with rich silk, on the back of the largest elephant, which is provided with a machine (*houder*) for that purpose. Within about an hundred yards of an open hall where the king sits, the cavalcade stops, and the ambassador dismounts, and makes his obeisance by bending his body, and lifting his joined hands to his head. When he enters the palace, if an European, he is obliged to take off his shoes; and having made a second obeisance, is seated upon a carpet on the floor, where *betel* is brought to him. The throne was some years ago of ivory and tortoiseshell; and when the place was governed by queens, a curtain of gauze was hung before it, which did not obstruct the audience, but prevented any perfect view. The stranger, after some general discourse, is then conducted to a separate building, where he is entertained with the delicacies of the country by the officers of state, and in the evening returns in the manner he came, surrounded by a prodigious number of lights. On high days (*arce ryah*) the king goes in great state, mounted on an elephant richly caparisoned, to the great mosque, preceded by his *ooloballangs*, who are armed nearly in the European manner."

The country under the immediate jurisdiction of Acheen, is divided into three districts, named *Duo-*

pooloo duo, *Duo-pooloo leemo*, and *Duo-pooloo anam*. Each district is governed by a *pangleemo*, and under him an *imaum* and four *pangeeches* to each mosque.

Acheen.
Achelous.

"Acheen has ever been remarkable for the severity with which crimes are punished by their laws: the same rigour still subsists, and there is no commutation admitted, as is regularly established in the southern countries. There is great reason, however, to conclude, that the poor alone experience the rod of justice; the nobles being secure from retribution in the number of their dependants. Petty theft is punished by suspending the criminal from a tree, with a gun or heavy weight tied to his feet; or by cutting off a finger, a hand, or leg, according to the nature of the theft. Many of these mutilated and wretched objects are daily to be seen in the streets. Robbery on the highway and house-breaking are punished by drowning, and afterwards exposing the body on a stake for a few days. If the robbery is committed upon an *imaum* or priest, the sacrilege is expiated by burning the criminal alive. A man who is convicted of adultery is seldom attempted to be screened by his friends, but is delivered up to the friends and relations of the injured husband. These take him to some large plain, and forming themselves in a circle, place him in the middle. A large weapon called a *gadoobong*, is then delivered to him by one of his family; and if he can force his way through those who surround him, and make his escape, he is not liable to further prosecution; but it commonly happens that he is instantly cut to pieces. In this case his relations bury him as they would a dead buffalo, refusing to admit the corpse into their house, or to perform any funeral rites." These discouragements to vice might seem to bespeak a moral and virtuous people: yet all travellers agree in representing the Achenese as one of the most dishonest and flagitious nations of the East.

Acheen was visited by the Portuguese in 1509. They made various attempts to establish themselves in the country, but were expelled with disgrace. The state is exposed to frequent convulsions, and in 1805 the prince was obliged to desert his capital. See SUMATRA.

ACHELOUS, in fabulous history, wrestled with Hercules, for no less a prize than Deianira, daughter of King Oeneus: but as Achelous had the power of assuming all shapes, the contest was long dubious: at last as he took that of a bull, Hercules tore off one of his horns; so that he was forced to submit, and to redeem it by giving the conqueror the horn of Amalthea, the same with the cornucopiae or horn of plenty; which Hercules having filled with a variety of fruits, consecrated to Jupiter. Some explain this fable, by saying, That Achelous is a winding river of Greece, whose stream was so rapid, that it roared like a bull, and overflowed its banks; but Hercules, by bringing it into two channels, broke off one of the horns, and so restored plenty to the country. See the next article.

ACHELOUS, a river of Acarnania; which rises in Mount Pindus, and, dividing Ætolia from Acarnania, falls from north to south into the Sinus Corinthiacus. It was formerly called *Thoas* from its impetuosity, and *king of rivers* (Homcr). The epithet *Achelous* is used for *Aqueus*, (Virgil); the ancients calling all water *Achelous*, especially in oaths, vows, and sacrifices, according to Ephorus: Now called *Aspro Potamo*. Rivers are by the ancient poets called *Tatrisiformes*,
either

Achelous
||
Achiar.

either from the bellowing of their waters, or from their ploughing the earth in their course: Hercules, restraining by dykes and mounds the inundations of the *Achelous*, is said to have broken off one of his horns, and to have brought back plenty to the country. See the preceding article.

ACHERI, LUKE D', a learned Benedictine of the congregation of St Maur, was born at St Quintin, in Picardy, in 1609; and made himself famous by printing several works, which till then were only in manuscript: particularly, the epistle attributed to St Barnabas; the works of Lanfranc, archbishop of Canterbury; a collection of scarce and curious pieces, under the title of *Spicilegium*, i. e. Gleanings, in thirteen volumes, quarto. The prefaces and notes, which he annexed to many of these pieces, show him to have been a man of genius and abilities. He had also some share in the pieces inserted in the first volumes of The Acts of the Saints of the order of St Benedict; the title whereof acquaints us that they were collected and published by him and Father Mabillon. After a very retired life, till the age of 73, he died at Paris the 29th of April 1685, in the abbey of St Germain in the Fields, where he had been librarian.

ACHERNER, or ACHARNER, a star of the first magnitude in the southern extremity of the constellation ERIDANUS, but invisible in our latitude.

ACHERON, in mythology, a river of Epirus. The poets feigned it to have been the son of Ceres, whom she hid in hell for fear of the Titans, and turned into a river, over which souls departed were ferried in their way to Elysium.

ACHERON, in *Ancient Geography*, a river of Thesprotia, in Epirus; which, after forming the lake Acherusia, at no great distance from the promontory of Chimerium, falls into the sea to the west of the Sinus Ambracius, in a course from north to south.

ACHERON, or ACHEROS, a river of the Bruttii in Italy, running from east to west; where Alexander king of Epirus was slain by the Lucani, being deceived by the oracle of Dodona, which bade him beware of Acheron.

ACHARSET, an ancient measure of corn, conjectured to be the same with our quarter, or eight bushels.

ACHERUSIA PALUS, a lake between Cumæ and the promontory Misenum, now *il Lago della Collucia*, (Cluverius). Some confound it with the *Lacus Lucrinus*, and others with the *Lacus Averni*. But Strabo and Pliny distinguish them. The former takes it to be an effusion, exundation, or washes of the sea, and therefore called by Lycophron, *Αχχυσία χυσις*.—Also a lake of Epirus, through which the Acheron runs.—There is also an *Acherusia*, a peninsula of Bithynia on the Euxine, near Heraclea; and a cave there of the same name, through which Hercules is fabled to have descended to hell to drag forth Cerberus.

ACHIAI, is a Malayan word, which signifies all sorts of fruits and roots pickled with vinegar and spice. The Dutch import from Batavia all sorts of achiar, but particularly that of BAMBOO, a kind of cane, extremely thick, which grows in the East Indies. It is preserved there, whilst it is still green, with very strong vinegar and spice; and is called *bamboo achiar*. The name changes according to the fruit with which the achiar is made.

ACHICOLUM, is used to express the *fornix*, *tholus*, or *sudatorium* of the ancient baths: which was a hot room where they used to sweat. It is also called *architholus*. Achicolum
||
Achilini.

ACHILLÆA, YARROW, MILFOIL, NOSEBLEED, or SNEEZEWORD. See BOTANY Index.

ACHILLEID, ACHILLEIS, a celebrated poem of Statius, in which that author proposed to deliver the whole life and exploits of Achilles; but being prevented by death, he has only treated of the infancy and education of his hero. See STATIUS.

ACHILLES, one of the greatest heroes of ancient Greece, was the son of Peleus and Thetis. He was a native of Phthia, in Thessaly. His mother, it is said, in order to consume every mortal part of his body, used to lay him every night under live coals, anointing him with ambrosia, which preserved every part from burning but one of his lips, owing to his having licked it. She dipped him also in the waters of the river Styx; by which his whole body became invulnerable, except that part of his heel by which she held him. But this opinion is not universal, nor is it a part of his character as drawn by Homer; for in the Iliad (B. xxi. 161.) he is actually wounded in the right arm, by the lance of Asteropeus, in the battle near the river Scamander. Thetis afterwards intrusted him to the care of the centaur Chiron, who, to give him the strength necessary for martial toil, fed him with honey and the marrow of lions and wild boars. To prevent his going to the siege of Troy, she disguised him in female apparel, and hid him among the maidens at the court of King Lycomedes: but Ulysses discovering him, persuaded him to follow the Greeks. Achilles distinguished himself by a number of heroic actions at the siege. Being disgusted, however, with Agamemnon for the loss of Briseis, he retired from the camp. But returning to avenge the death of his friend Patroclus, he slew Hector, fastened his corpse to his chariot, and dragged it round the walls of Troy. At last Paris, the brother of Hector, wounded him in the heel with an arrow, while he was in the temple treating about his marriage with Philoxena, daughter of King Priam. Of this wound he died, and was interred on the promontory of Sigæum: and after Troy was taken, the Greeks sacrificed Philoxena on his tomb, in obedience to his desire, that he might enjoy her company in the Elysian fields. It is said, that Alexander, seeing this tomb, honoured it by placing a crown upon it; at the same time crying out, that "Achilles was happy in having, during his life, such a friend as Patroclus; and, after his death, a poet like Homer." Achilles is supposed to have died 1183 years before the Christian era.

ACHILLES Tutius. See TATIUS.

Tendo ACHILLIS, in *Anatomy*, is a strong tendinous cord formed by the tendons of several muscles, and inserted into the os calcis. It has its name from the fatal wound Achilles is said to have received in that part from Paris the son of Priam.

ACHILLINI, ALEXANDER, born at Bologna, and doctor of philosophy in that university. He flourished in the 15th and 16th centuries, and by way of eminence was styled the Great Philosopher. He was a steadfast follower and accurate interpreter of Averroes upon Aristotle, but most admired for his acuteness and strength of arguing in private and public disputations.

He,

Achillini
||
Achmet.

He made a surprising quick progress in his studies, and was very early promoted to a professorship in the university; in which he acquitted himself with so much applause that his name became famous throughout all Italy. He continued at Bologna till the year 1506; when the university of Padua made choice of him to succeed Antonio Francatiano in the first chair of philosophy, and his fame brought vast numbers of students to his lectures at Padua: but the war, wherein the republic of Venice was engaged against the league of Cambray, putting a stop to the lectures of that university, he withdrew to his native country, where he was received with the same marks of honour and distinction as before, and again appointed professor of philosophy in Bologna. He spent the remainder of his life in this city, where he died, and was interred with great pomp in the church of St Martin the Great, which belongs to the Carmelite friars. Jovius, who knew Achillini, and heard his lectures, says, that he was a man of such exceeding simplicity, and so unacquainted with address and flattery, that he was a laughing stock to the pert and saucy young scholars, although esteemed on account of his learning. He wrote several pieces on philosophical subjects, which he published, and dedicated to John Bentivogli.

ACHILLINI, *Claudius*, grandson of the former, read lectures at Bologna, Ferrara, and Parma; where he was reputed a great philosopher, a learned divine, an excellent lawyer, an eloquent orator, a good mathematician, and an elegant poet. He accompanied Cardinal Ludovino, who went as legate into Piedmont; but being afterward neglected by this cardinal, when he became pope under the name of Gregory XV. he left Rome in disgust, and retired to Parma; where the duke appointed him professor of law, with a good salary. A canzone which he addressed to Louis XIII. on the birth of the dauphin, is said to have been rewarded by Cardinal Richlieu, with a gold chain of the value of 1000 crowns. He published a volume of Latin letters, and another of Italian poems, which gained him great reputation. He died in 1640, aged 66.

ACHIOTTE, or ACHIOTL, a foreign drug, used in dying and in the preparation of chocolate. It is the same with the substance more usually known by the name of ARNOTTO. See BIXA, BOTANY Index.

ACHIROPOETOS, a name given by ancient writers to certain miraculous pictures of Christ and the Virgin, supposed to have been made without hands.—The most celebrated of these is the picture of Christ, preserved in the church of St John Lateran at Rome; said to have been begun by St Luke, but finished by the ministry of angels.

ACHMET, son of Seerim, an Arabian author, has left a book concerning the interpretation of dreams according to the doctrine of the Indians, Persians, and Egyptians, which was translated into Greek and Latin. The original is now lost. He lived about the 4th century.

ACHMET I. emperor of the Turks, the third son and successor of Mahomet III. ascended the throne before he reached the age of fifteen. During the period of his reign, the Turkish empire enjoyed at one time great prosperity, and at another was depressed with adversity. The Asiatic rebels, who took refuge in Persia, involved the two empires in a war, during which the Turks

lost Bagdad, to recover which every effort proved unsuccessful. In his reign Transylvania and Hungary were the scenes of war between the Turks and Germans. In addition to the calamities and distresses of war abroad and internal tumults and broils, a pretender to his throne disturbed his repose, and made attempts on his life. He was much devoted to amusements; and spent his time chiefly in the haram and in the sports of the field. His seraglio consisted of 3000 women; and his hunting establishment was composed of 40,000 falconers, and an equal number of huntsmen, in different parts of his dominions. He expended great sums of money in building, and particularly on a magnificent mosque which he erected in the Hippodrome. Achmet was less cruel than some of his predecessors; but he was haughty and ambitious. He died in 1617 at the age of 29. His three sons successively ascended the throne after him. (*Gen. Biog.*)

ACHMET II. emperor of the Turks, son of Sultan Ibrahim, succeeded his brother Solyman in 1691. The administration of affairs during his reign was feeble and unsettled. The Ottoman territory was overrun by the imperialists; the Venetians seized the Morea, took the isle of Chios, and several places in Dalmatia; and the Arabs attacked and plundered a caravan of pilgrims, and even laid siege to Mecca. Though he never discovered the vigour and sagacity that are essentially requisite in the character of a sovereign, in private life he was mild, devout, and inoffensive. He was fond of poetry and music; and to those about his person, he was cheerful and amiable. He died in 1695 at the age of 50.

ACHMET III. emperor of the Turks, son of Mahomet IV. succeeded his brother Mustapha II. who was deposed in 1703. After he had settled the discontents of the empire, his great object was to amass wealth. With this view he debased the coin, and imposed new taxes. He received Charles XII. of Sweden, who took refuge in his dominions, after the battle of Pultowa in 1709, with great hospitality; and, influenced by the sultana mother, he declared war against the Czar Peter, Charles's formidable rival. Achmet recovered the Morea from the Venetians; but his expedition into Hungary was less fortunate, for his army was defeated by Prince Eugene at the battle of Peterwaradin in 1716. As the public measures of Achmet were influenced by ministers and favourites, the empire during his reign was frequently distracted by political struggles and revolutions. The discontent and sedition of his soldiers at last drove him from the throne. He was deposed in 1730, and succeeded by his nephew Mahomet V. He was confined in the same apartment which had been occupied by his successor previous to his elevation to the throne, and died of an apoplexy in 1736, at the age of 74. The intentions of this prince, it is said, were upright; but his talents were moderate, never discovering that vigour of mind and steadiness of action which are so necessary in the character of a sovereign. Excessive confidence in his vizier diminished the splendour of his reign, and probably tended to shorten the period of it. (*Gen. Biog.*)

ACHMET GEDUC, a famous general under Mahomet II. and Bajazet II. in the 15th century. When Mahomet II. died, Bajazet and Zezan both claimed the throne: Achmet sided with the former, and by his bravery

Achmet.

Achmet
||
Achmim.

bravery and conduct fixed the crown on his head. But Bajazet took away his life; shining virtue being always an unpardonable crime in the eyes of a tyrant.

ACHMETSCHET, a town of the peninsula of the Crimea, the residence of the sultan Galga, who is eldest son of the khan of Tartary. E. Long. 52. 20. N. Lat. 45. 35.

ACHMIM, a large town of Upper Egypt, situated on the eastern bank of the Nile. "One admires there (says Abulfeda, as quoted by M. Savary) a temple which is comparable to the most celebrated monuments of antiquity. It is constructed with stones of a surprising size, on which are sculptured innumerable figures." Though this town be fallen from its ancient splendour, it is still one of the most beautiful of Upper Egypt. According to M. Savary, an Arab prince commands there, and the police is well attended to. The streets are wide and clean, and commerce and agriculture flourish. It has a manufacture of cotton stuffs, and pottery, which are conveyed over all Egypt. It is the same that Herodotus calls *Chemmis*, and Strabo *Panopolis*, or the city of Pan, who was worshipped there. Herodotus says, that Perseus was a native of this city, and that his descendants had established festivals there in his honour. It has lost its ancient edifices, and much of its extent; the ruins of the temple, described by Abulfeda, being without its limits to the north. Nothing remains of it but some stones, of such magnitude that the Turks have not been able to move them. They are covered with hieroglyphics. On one of them are traced four concentric circles, in a square. The innermost of these contains a sun. The two succeeding ones, divided into 12 parts, contain, one, 12 birds, the other, 12 animals, almost effaced, which appear to be the signs of the zodiac. The fourth has no divisions, and presents 12 human figures: which M. Savary imagines to represent the 12 gods, the 12 months of the year, and the 12 signs of the zodiac. The Egyptians, says Herodotus, were the first who divided the year into 12 months, and employed the names of the 12 gods. The four seasons occupy the angles of the square, on the side of which may be distinguished a globe with wings. M. Savary thinks it probable that this stone belonged to a temple dedicated to the sun, that the whole of these hieroglyphics mark his passage into the signs of the zodiac, and his course, whose revolution forms the year. The columns of this temple have been partly broken to make lime and millstones. Some of them have been transported into one of the mosques of Achmim, where they are placed without taste; others are heaped up in the squares of the town.

M. Savary tells us of a serpent which is worshipped here, and is the wonder of the country. "Upwards of a century ago (says he) a religious Turk called *Sheik Haridi* died here. He passed for a saint among the Mahometans; who raised a monument to him, covered with a cupola, at the foot of the mountain. The people flocked from all parts to offer up their prayers to him. One of their priests, profiting by their credulity, persuaded them that God had made the soul of *Scheik Haridi* pass into the body of a serpent. Many of these are found in the Thebais, which are harmless; and he had taught one to obey his voice. He appeared with his serpent, dazzled the vulgar by his surprising tricks, and pretended to cure all disorders.

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Some lucky instances of success, due to nature alone, and sometimes to the imagination of the patients, gave him great celebrity. He soon consigned his serpent *Haridi* to the tomb, producing him only to oblige princes and persons capable of giving him a handsome recompense. The successors of this priest, brought up in the same principles, found no difficulty in giving sanction to so advantageous an error. They added to the general persuasion of his virtue that of his immortality. They had the boldness even to make a public proof of it. The serpent was cut in pieces in presence of the emir, and placed for two hours under a vase. At the instant of lifting up the vase, the priests, no doubt, had the address to substitute one exactly resembling it. A miracle was proclaimed, and the immortal *Haridi* acquired a fresh degree of consideration. This knavery procures them great advantages. The people flock from all quarters to pray at this tomb; and if the serpent crawls out from under the stone, and approaches the suppliant, it is a sign that his malady will be cured. It may be imagined that he does not appear till an offering has been made proportioned to the quality and riches of the different persons. In extraordinary cases, where the sick persons cannot be cured without the presence of the serpent, a *pure virgin* must come to solicit him. To avoid inconveniences on this head, they take care to choose a *very young girl indeed*. She is decked out in her best clothes, and crowned with flowers. She puts herself in a praying attitude; and as the priests are inclined, the serpent comes out, makes circles round the young suppliant, and goes and reposes on her. The virgin, accompanied by a vast multitude, carries him in triumph amidst the general acclamation. No human reasoning would persuade these ignorant and credulous Egyptians that they are the dupes of a few impostors; they believe in the serpent *Haridi* as firmly as in the prophet." E. Long. 31. 55. N. Lat. 26. 40.

ACHONRY, a small town of Ireland, in the province of Connaught and county of Sligo, seated on the river Shannon.

ACHOR, a valley of Jericho, lying along the river Jordan, not far from Gilgal; so called from Achan, the troubler of Israel, being there stoned to death.

ACHOR, in *Medicine*, a species of HERPES.

ACHOR, in *Mythology*, the god of flies; to whom, according to Pliny, the inhabitants of Cyrene sacrificed, in order to obtain deliverance from the insects and the disorders occasioned by them.

ACHRADINA, in *Ancient Geography*, one of the four cities or divisions of Syracuse, and the strongest, largest, and most beautiful part of it; separated by a very strong wall from the outer town, *Tycha* and *Neapolis*. It was adorned with a very large forum, with beautiful porticoes, a most elegant prytaneum, a spacious senate-house, and a superb temple of Jupiter Olympius.

ACHRAS, or SAPOTA PLUM. See BOTANY *Indea*.

ACHROMATIC, an epithet expressing want of colour. The word is Greek, being compounded of a privative, and *χρῶμα*, colour. This term was first introduced into astronomy by De la Lande.

ACHROMATIC Telescopes, are telescopes contrived to remedy the aberrations in colours. They were invented

Achmim
||
Achromatic.

S

ed

Achromatic
||
Acidalus.

ed by Mr John Dollond, optician, and have been since improved by his son and others. See ABERRATION.—A more particular account of the invention and construction of these instruments will be found under OPTICS.

ACHTELING, a measure for liquids used in Germany. Thirty-two *achtelings* make a *heemer*; four *sciltims* or *sciltins* make an *achteling*.

ACHYR, a strong town and castle of the Ukraïn, subject to the Russians since 1667. It stands on the river Uorsklo, near the frontiers of Russia, 127 miles west of Kiow. E. Long. 36. 0. N. Lat. 49. 32.

ACHYRANTHES, in *Botany*. See BOTANY Index.

ACICANTHERA, in *Botany*, the trivial name of a species of RHEXIA.

ACICULÆ, the small pikes or prickles of the hedgehog, *echinus marinus*, &c.

ACIDALIUS, VALENS, would, in all probability, have been one of the greatest critics in these latter ages, had he lived longer to perfect those talents which nature had given him. He was born at Witstock, in Brandenburg; and having visited several academies in Germany, Italy, and other countries, where he was greatly esteemed, he afterwards took up his residence at Breslaw, the metropolis of Silesia. Here he remained a considerable time, in expectation of some employment; but nothing offering, he turned Roman Catholic, and was chosen rector of a school at Niessa. It is related, that about four months after, as he was following a procession of the host, he was seized with a sudden plerensy; and being carried home, expired in a very short time. But Thuanus tells us, that his excessive application to study was the occasion of his untimely death; and that his sitting up in the night composing his Conjectures on Plantus, brought upon him a distemper which carried him off in three days, on the 25th of May 1595, being just turned of 28. He wrote a Commentary on Quintus Curtius; also, Notes on Tacitus, on the twelve Panegyrics; besides speeches, letters, and poems. His poetical pieces are inserted in the *Delicie* of the German poets, and consist of epic verses, odes, and epigrams. A little work printed in 1595, under the title of *Mulieres non esse homines*, "That women were not of the human species," was falsely ascribed to him. But the fact was, that Acidalius happening to meet with the manuscript, and thinking it very whimsical, transcribed it, and gave it to the bookseller, who printed it. The performance was highly censured, so that the bookseller being seized, he discovered the person who gave him the manuscript, and a terrible outcry was made against Acidalius. A story goes, that being one day to dine at a friend's house, there happened to be several ladies at table; who supposing him to be the author, were moved with so much indignation, that they threatened to throw their plates at his head. Acidalius, however, ingeniously diverted their wrath. In his opinion, he said, the author was a judicious person, the ladies being certainly more of the species of *angels* than of *men*.—Mr Baillet has given him a place among his *Enfans Celebres*; and says, that he wrote a comment upon Plautus when he was but 17 or 18 years old, and that he composed several Latin poems at the same age.

ACIDALUS, a fountain in Orchomenus, a city of

Bœotia, in which the Graces, who are sacred to Venus, bathed. Hence the epithet *Acidalia*, given to Venus, (Virgil.)

Acidalus
||
Acids.

ACIDITY, that quality which renders bodies acid. ACIDOTON, in *Botany*, the trivial name of a species of ADELIA.

ACIDS, in *Chemistry*, a class of substances which are distinguished by the following properties.

1. When applied to the tongue, they excite that sensation which is called *sour* or *acid*.

2. They change the blue colours of vegetables to a red. The vegetable blues employed for this purpose are generally tincture of litmus and syrup of violets or of radishes, which have obtained the name of *reagents* or *tests*. If these colours have been previously converted to a *green* by alkalies, the acids restore them again.

3. They unite with water in almost any proportion.

4. They combine with all the alkalies, and most of the metallic oxides and earths, and form with them those compounds which are called *salts*.

It must be remarked, however, that every acid does not possess all these properties; but all of them possess a sufficient number of them to distinguish them from other substances. And this is the only purpose which artificial definition is meant to answer.

The acids are by far the most important class of bodies in chemistry. It was by their means indeed, by studying their properties, and by employing them as instruments in the examination of other bodies, that men of science laid the foundation of chemistry, and brought it to that state in which we find it at present. The nature and composition of acids, therefore, became a very important point of discussion, and occupied the attention of the most eminent cultivators of the science.

Paracelsus believed that there was only one acid principle in nature, which communicated taste and solubility to the bodies in which it was combined. Beccher embraced the same opinion; and added to it, that this acid principle was a compound of earth and water, which he considered as two elements. Stahl adopted the theory of Beccher, and endeavoured to prove that his acid principle is sulphuric acid; of which, according to him, all the other acids are mere compounds. But his proofs were only conjectures or vague experiments, from which nothing could be deduced. Nevertheless, his opinion, like every other which he advanced in chemistry, continued to have supporters for a long time, and was even countenanced by Macquer. At last its defects began to be perceived; Bergman and Scheele declared openly against it; and their discoveries, together with those of Lavoisier, demonstrated the falsehood of both parts of the theory, by shewing that sulphuric acid does not exist in the other acids, and that it is not composed of water and earth, but of sulphur and oxygen.

The opinion, however, that acidity is owing to some principle common to all the salts, was not abandoned. Wallerius, Meyer, and Sage, had advanced different theories in succession about the nature of this principle; but as they were founded rather on conjecture and analogy than direct proof, they obtained but few advocates. At last M. Lavoisier, by a number of ingenious and accurate experiments, proved that several combustible

Acids. combustible substances, when united with oxygen, form acids; that a great number of acids contain oxygen; and that when this principle is separated from them, they lose their acid properties. He concluded, therefore, that the acidifying principle is oxygen, and that acids are nothing else but combustible substances combined with oxygen, and differing from one another according to the nature of the combustible base.

This conclusion, as far as regards the greater number of acids, is certainly true. All the simple combustibles, except hydrogen, are convertible into acids; and these acids are composed of oxygen and the combustible body combined: this is the case also with four of the metals. It must not, however, be admitted without some limitation.

1. When it is said that oxygen is the acidifying principle, it is not meant surely to affirm that oxygen possesses the properties of an acid, which would be contrary to truth; all that can be meant is, that it enters as a component part into acids, or that acids contain it as an essential ingredient.

2. But, even in this sense, the assertion cannot be admitted: for it is not true that oxygen is an essential ingredient in all acids, or that no body possesses the property of an acid unless it contains oxygen. Sulphurated hydrogen, for instance, possesses all the characters of an acid, yet it contains no oxygen.

3. When it is said that oxygen is the acidifying principle, it cannot be meant surely to affirm that the combination of oxygen with bodies produces in all cases an acid, or that whenever a body is combined with oxygen, the product is an acid; for the contrary is known to every chemist. Hydrogen, for instance, when combined with oxygen, forms not an acid, but water, and the greater number of metallic bodies form only oxides.

All that can be meant, then, when it is said that oxygen is the acidifying principle, is merely that it exists as a component part in the greater number of acids; and that many acids are formed by combustion, or by some equivalent process. The truth is, that the class of acids is altogether arbitrary; formed when the greater number of the bodies arranged under it were unknown, and before any precise notion of what ought to constitute the characteristic marks of an acid had been thought of. New bodies, when they were discovered, if they possessed any properties analogous to the known acids, were referred without scruple to the same class, how much soever they differed from them in other particulars. Hence we find, under the head of acids, bodies which have scarcely a single property in common, except that of combining with alkalies and earths. What substances, for instance, can be more dissimilar than sulphuric, prussic and uric acids? Hence the difficulty of assigning the general characters of the class of acids, and the disputes which have arisen about the propriety of classing certain bodies among acids. If we lay it down as an axiom that oxygen is the acidifying principle, we must either include among acids a great number of bodies which have not the smallest resemblance to those substances which are at present reckoned acids, or exclude from the class several bodies which have the properties of acids in perfection. The class of acids being perfectly arbitrary, there can-

not be such a thing as an acidifying principle in the most extensive sense of the word.

The acids at present known amount to about 30; and all of them, eight excepted, have been discovered within these last 40 years. They may be arranged under two general heads: 1. Acids composed of two ingredients. 2. Acids composed of more than two component parts. (*Thomson's Chemistry.*) See CHEMISTRY.

ACIDULOUS, denotes a thing that is slightly acid: it is synonymous with the word *sub-acid*.

ACIDULÆ. Mineral waters that are brisk and sparkling without the action of heat are thus named; but if they are hot also, they are called THERMÆ.

ACIDULATED, a name given to medicines that have an acid in their composition.

ACIDUM AEREUM, the same with *fixed air*; or, in modern chemistry, *carbonic acid*.

ACIDUM pingue, an imaginary acid, which some German chemists supposed to be contained in fire, and by combining with alkalies, lime, &c. to give them their caustic properties; an effect which is found certainly to depend on the loss of their carbonic acid.

ACILA, in *Ancient Geography*, a staple or mart town in Arabia Felix, on the Arabian gulf, from which, according to Pliny, the Scenitæ Sabæi set sail for India. Now Ziden.

ACILISENE, in *Ancient Geography*, a district of the lesser Armenia towards the head of the Euphrates, having that river on the west, and on the south a river to which Xenophon and Pliny seem to have given the same name.

ACILIUS GLABRIO, MARCUS, consul in the year of Rome 562, and 211 years before the Christian era, distinguished himself by his bravery and conduct in gaining a complete victory over Antiochus the Great, king of Syria, at the straits of Thermopylæ in Thessaly, and on several other occasions. He built the temple of Piety at Rome, in consequence of a vow which he made before this battle. He is mentioned by Pliny, Valerius Maximus, and others.

ACINASIS, in *Ancient Geography*, a river of Asia, at the southern extremity of Colchis, which discharges itself into the Euxine sea, between the Bathys and the Isis. It is mentioned by Arrian in his Periplus.

ACINIPPO, in *Ancient Geography*, a town of Bætica: its ruins, called *Ronda la Vieja*, are to be seen near Arundá, in the kingdom of Granada.

ACINODENDRUM, in *Botany*, the trivial name of a species of MELASTOMA.

ACINOS, in *Botany*, the trivial name of a species of THYMUS. See BOTANY Index.

ACINUS, or ACINI, the small protuberances of mulberries, strawberries, &c. and by some applied to grapes. Generally it is used for those small grains growing in bunches, after the manner of grapes, as *ligustrum*, &c.

ACIS, in *Mythology*, the son of Faunus and the nymph Simaethis, was a beautiful shepherd of Sicily, who being beloved by Galatea, Polyphemus the giant was so enraged, that he dashed out his brains against a rock; after which Galatea turned him into a river, which was called by his name.

The Sicilian authors say, that Acis was a king of this

Acids
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Acis.

Acis
||
Acoemetae.

this part of the island, who was slain by Polyphemus, one of the giants of Ætna, in a fit of jealousy.

ACIS, a river of Sicily, celebrated by the poets, running from a very cold spring, in the woody and shady foot of Mount Ætna, for the space of a mile eastward into the sea, along green and pleasant banks, with the speed of an arrow, from which it takes its name. Its waters are now impregnated with sulphureous vapours, though formerly they were celebrated for their sweetness and salubrity, and were held sacred by the Sicilian shepherds :

*Quique per Ætnæos Acis petit æquora fines,
Et dulci gratam Nereïda perluit unda.* SIL. ITAL.

It is now called *Il Fiume Fredda, Aci, Iaci*, or *Chiaci*, according to the different Sicilian dialects: Antonine calls it *Acius*. It is also the name of a hamlet at the mouth of the *Acis*.

ACKERMANN, JOHN C. GOTTLIEB, an eminent German medical writer. See SUPPLEMENT.

ACKNOWLEDGMENT, in a general sense, is a person's owning or confessing a thing; but more particularly, is the expression of gratitude for a favour.

ACKNOWLEDGMENT-Money, a certain sum paid by tenants, in several parts of England, on the death of their landlords, as an acknowledgment of their new lords.

ACLIDES, in Roman antiquity, a kind of missile weapon, with a thong affixed to it, by which it was drawn back. Most authors describe it as a sort of dart or javelin; but Scaliger makes it roundish or globular, and full of spikes, with a slender wooden stem to poise it by. Each warrior was furnished with two.

ACLOWA, in *Botany*, a barbarous name of a species of *COLUTEA*. It is used by the natives of Guinea to cure the itch: They rub it on the body as we do unguents. See *COLUTEA*, *BOTANY Index*.

ACME, the top or height of any thing. It is usually applied to the maturity of an animal just before it begins to decline; and physicians have used it to express the utmost violence or crisis of a disease.

ACMELIA, in *Botany*, the trivial name of a species of *SPILANTHUS*. See *BOTANY Index*.

ACMODÆ, in *Ancient Geography*, seven islands in the British sea, supposed by some to be the Scilly islands, but by others those of Shetland near the Orkneys, on the northern coast of Scotland.

ACMONIA, and **AGMONIA**, in Peutinger's map, a town of Phrygia Major, now in ruins. The inhabitants are called *Acmonenses* by Cicero, and the city *Civitas Acmonensis*. Also a city of Dacia (Ptolemy), on the Danube, near the ruins of Trajan's bridge, built by Severus, and called *Severicum*; distant 12 German miles from Temeswar, to the south-east.

ACNIDA, VIRGINIAN HEMP. See *BOTANY Index*.

ACNUA, in Roman antiquity, signified a certain measure of land, about an English rood, or fourth part of an acre.

ACO, in *Geography*, a town of Pern in South America. It is also the name of a river in Africa, which rises in the Abyssinian mountains, runs in a south-east course, and discharges itself into the Indian ocean.

ACOEMETÆ, or **ACOEMETI**, in church history, or, Men who lived without sleep; a set of monks who chanted the divine service night and day in their places of worship. They divided themselves into three bo-

dies, who alternately succeeded one another, so that the service in their churches was never interrupted. This practice they founded upon the precept, *Pray without ceasing*. They flourished in the east about the middle of the 5th century. There are a kind of acoemeti still subsisting in the Romish church, viz. the religious of the holy sacrament, who keep up a perpetual adoration, some one or other of them praying before the holy sacrament day and night.

ACOLA, in *Ancient Geography*, a town in Media, on the borders of the Hyrcanian sea.

ACOLUTHI, or **ACOLUTHISTS**, in antiquity, was an appellation given to those persons who were steady and immovable in their resolutions; and hence the Stoics, because they would not forsake their principles, nor alter their resolutions, acquired the title of *acoluti*. The word is Greek, and compounded of *α* privative, and *κολεω*, way; as never turning from the original course.

ACOLUTHI, among the ancient Christians, implied a peculiar order of the inferior clergy in the Latin church, for they were unknown to the Greeks for above 400 years. They were next to the subdeacon; and we learn from the fourth council of Carthage, that the archdeacon, at their ordination, put into their hands a candlestick with a taper, giving them thereby to understand that they were appointed to light the candles of the church; as also an empty pitcher, to imply that they were to furnish wine for the eucharist. Some think they had another office, that of attending the bishop wherever he went. The word is Greek, and compounded of *α* privative, and *κολλω*, to hinder or disturb.

ACOLYTHIA, in the Greek church, denotes the office or order of divine service; or the prayers, ceremonies, hymns, &c. whereof the Greek service is composed.

ACOMA, a town of New Mexico, seated on a hill, with a strong castle. To reach the town, you walk up 50 steps cut out of the rock. It is the capital of that province, and was taken by the Spaniards in 1599. W. Long. 104. 15. Lat. 35. 0.

ACOMINATUS, NICETAS, was secretary to Alexius Comnenus and to Isaacus Angelus successively: he wrote a history from the death of Alexius Comnenus in 1118, where Zonaras ended his, to the year 1203, which has gone through many editions, and has been much applauded by the best critics.

ACONCROBA, in *Botany*, the indigenous name of a plant which grows wild in Guinea, and is in great esteem among the natives for its virtues in the small-pox. They give an infusion of it in wine. The leaves of this plant are opaque, and as stiff as those of the phillyrea: they grow in pairs, and stand on short footstalks; they are small at each end, and broad in the middle; and the largest of them are about three inches in length, and an inch and a quarter in breadth in the middle. Like those of our bay, they are of a dusky colour on the upper side, and of a pale green underneath.

ACONITE. See *ACONITUM*, *BOTANY Index*.

Winter ACONITE. See *HELLEBORUS*, *BOTANY Index*.

ACONITI, in antiquity, an appellation given to some of the *ATHLETÆ*, but differently interpreted. Mercurialis understands it of those who only anointed their

Acoemetae
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Aconiti.

Aconiti
||
Acosta.

their bodies with oil, but did not smear themselves over with dust, as was the usual practice.

ACONITUM, **ACONITE**, **WOLFSEANE**, or **MONKSHOOD**. See **BOTANY Index**.

ACONTIAS, in *Zoology*, an obsolete name of the anguis jaculus, or dart-snake, belonging to the order of amphibia serpentes. See **ANGUIS**.

ACONTIUM, *ακόντιον*, in Grecian antiquity, a kind of dart or javelin, resembling the Roman pilum.

ACONTIUS, a young man of the island Cea, who having gone to Delos, to see the sacred rites which were performed there by a crowd of virgins in the temple of Diana, fell desperately in love with Cydippe; but not daring to ask her in marriage, on account of the meanness of his birth, insidiously threw down at her feet an apple, on which were inscribed these words, *Me tibi nupturam, (felix eat omen,) Aconti, Juro, quam colimus, numina magna Deæ*. Or according to others, *Juro tibi sacræ per mystica sacra Diane, Me tibi venturam comitem, sponsamque futuram*. The virgin having taken up the apple, inadvertently read the words, and thus apparently bound herself by a promise; for by law, every thing uttered in that temple was held to be ratified. When her father, a little after, ignorant of what had happened, betrothed her to another man, she was suddenly seized with a fever. Whereupon Acontius sent her a letter, (expressed by Ovid, Ep. 20.) to persuade her that her fever was caused by Diana for not having fulfilled the promise which she had made to him in the temple of that goddess. Cydippe therefore resolved to comply with the wishes of Acontius, even against the inclination of her father. Her answer is the subject of Ovid's 21st epistle. (*Adam's Clas. Biog.*)

ACONTIUS, *James*, a philosopher, civilian, and divine, born at Trent in the 16th century. He embraced the reformed religion; and coming into England in the reign of Queen Elizabeth, he was favourably received and much honoured by that princess, which he acknowledges in a book dedicated to her. This work is his celebrated Collection of the Strata-gems of Satan, which has been so often translated, and passed through so many editions.

ACORN, the fruit of the oak tree. See **QUERCUS**, **BOTANY Index**.

ACORN, in sea language, a little ornamental piece of wood, fashioned like a cone, and fixed on the uppermost point of the spindle, above the vane, on the mast-head. It is used to keep the vane from being blown off from the spindle in a whirlwind, or when the ship leans much to one side under sail.

ACORUS, **CALAMUS AROMATICUS**, **SWEET FLAG**, or **SWEET RUSH**. See **BOTANY Index**.

ACORUS, in the *Materia Medica*, a name sometimes given to the great galangal. See **KEMPFERIA**.

ACORUS, in *Natural History*, blue coral. The true sort is very scarce; some, however, is fished on the coasts of Africa, particularly from Rio del Re to the river of the Camarones. This coral is part of the merchandise which the Dutch trade for with the Camarones: that of the kingdom of Benin is also very much esteemed. It grows in form of a tree on a rocky bottom.

ACOSTA, **JOSEPH D'**, a celebrated Spanish writer. See **SUPPLEMENT**.

ACOSTA, **URIEL**, a Portuguese, born at Oporto

Acosta.

towards the close of the 16th century. He was educated in the Romish religion, which his father also professed, though descended from one of those Jewish families who had been in a manner forced to receive baptism. Uriel had a liberal education. He was instructed in several sciences; and at last he studied law. He had by nature a good temper and mild disposition; and religion had made so deep an impression on his mind, that he ardently desired to conform to all the precepts of the church, to avoid eternal death, which he dreaded. He applied with great assiduity to reading the Scriptures and other religious books, carefully consulting also the creed of the confessors; but the more he studied, the more difficulties occurred, which perplexed him at length to such a degree, that, being unable to solve them, he fell into the most terrible agonies of mind. He thought it impossible to fulfil his duty with regard to the conditions required for absolution; so that he despaired of salvation, if he could find no other means of attaining it; and it proved difficult to abandon a religion in which he had been bred up from his infancy, and which had been deeply rooted in his mind. However he began to inquire, whether several particulars mentioned about the other life were agreeable to reason; and, upon inquiry and deliberation, he imagined that reason suggested many arguments against them. Acosta was about two and twenty, when he was thus perplexed with doubts: and the result of his reflections was, that he could not be saved by the religion which he had imbibed in his infancy. Nevertheless he prosecuted his studies in the law; and at the age of five and twenty, was made treasurer in a collegiate church. Being naturally of a religious disposition, and now made uneasy by the popish doctrines, he began to study Moses and the prophets; where he thought he found more satisfaction than in the gospel, and at length became convinced that Judaism was the true religion: and, as he could not profess it in Portugal, he resolved to leave the country. He accordingly resigned his place, and embarked for Amsterdam with his mother and brothers; whom he had ventured to instruct in the principles of the Jewish religion, even when in Portugal. Soon after their arrival in Amsterdam, they became members of the synagogue; were circumcised according to custom; and he changed his name of Gabriel for that of Uriel. A little time was sufficient to shew him, that the Jews did neither in their rites nor morals conform to the law of Moses, of which he could not but declare his disapprobation: but the chiefs of the synagogue gave him to understand, that he must exactly observe their tenets and customs; and that he would be excommunicated, if he deviated in the least from them. This threat, however, had no effect; for he thought it would be a most mean behaviour in him, who had left the sweets of his native country purely for liberty of conscience, to submit to a set of Rabbis without any proper jurisdiction; and that it would shew both want of courage and piety, if he should stifle his sentiments on this occasion. He therefore persisted in his invectives, and in consequence was excommunicated: the effect of which was such, that his own brothers durst not speak to him, nor salute him when they met him in the streets. Finding himself thus situated, he wrote a book in his justification, wherein he endeavours to shew, that the rites and traditions

Acosta.

ditions of the Pharisees are contrary to the writings of Moses, and soon after adopted the opinion of the Sadducees: for he had worked himself up to a belief, that the rewards and punishments of the old law relate only to this life; and this, because Moses nowhere mentions the joys of heaven, or the torments of hell. His adversaries were overjoyed at his embracing this tenet; foreseeing, that it would tend greatly to justify, in the sight of Christians, the proceedings of the synagogues against him. Before his book was printed, there appeared a piece upon the immortality of the soul, written by a physician, who omitted nothing he could suggest to make Acosta pass for an atheist. The very children were encouraged to insult him in the streets, and to batter his house with stones; all which however did not prevent him from writing a treatise against the physician, wherein he endeavoured to confute the doctrine of the soul's immortality. The Jews now made application to the magistrates of Amsterdam; and informed against him, as one who wanted to undermine the foundation of both Jewish and Christian religions. He was thrown into prison, but bailed out within a week or ten days after; however all the copies of his works were seized, and he himself fined in 300 florins. Nevertheless, he proceeded still farther in his scepticism. He now began to examine, whether the law of Moses came from God; and he supposed he had at length found reasons to convince him, that it was only a political invention. Yet, instead of drawing this inference from thence, "I ought not to return to the Jewish communion," he thus argued with himself, "Why should I continue all my life cut off from the communion, exposed to so many inconveniences, especially as I am in a country where I am a stranger, and unacquainted with the language? Had I not better play the ape among apes?" He accordingly returned to the Jewish church, after he had been excommunicated 15 years; and, after having made a recantation of what he had written, subscribed every thing as they directed. A few days after, he was accused by a nephew, who lived in his house, that he did not, as to his eating and many other points, conform to the laws of the synagogue. This accusation was attended with very bad consequences; for a relation of Acosta, who had got him reconciled to the synagogue, thought he was in honour bound to persecute him with the utmost violence. The Rabbis and the rest of the Jews were animated with the same spirit; especially, when they found that Acosta had dissuaded two Christians,

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who had come from London to Amsterdam, from turning Jews. He was summoned before the grand council of the synagogue; when it was declared to him, that he must again be excommunicated, if he did not give such satisfaction as should be required. He found the terms so hard, that he could not comply. The Jews thereupon again expelled him from their communion; and he afterwards suffered various hardships and great persecutions, even from his own relations. After remaining seven years in a most wretched situation, he at length declared he was willing to submit to the sentence of the synagogue, having been told that he might easily accommodate matters; for, that the judges, being satisfied with his submission, would soften the severity of the discipline. Acosta, however, was caught in a snare; for they made him undergo the most rigorous penance. These particulars relating to the life of Acosta, are taken from his work, entitled, "*Exemplar humanæ Vitæ*," published and refuted by Limborch. It is supposed that he composed it a few days before his death, after having determined to lay violent hands on himself. He executed this horrid resolution a little after he had failed in his attempt to kill his principal enemy; for the pistol, with which he intended to have shot him as he passed his house, having missed fire, he immediately shut the door, and shot himself with another pistol. This happened at Amsterdam, but in what year is not exactly known.

ACOSTAN, a mountainous island in the north seas between Asia and America, observed by Captain Cook.

ACOUSMATICI, sometimes also called *Acoustici*, in Grecian antiquity, such of the disciples of Pythagoras as had not completed their five years probation.

ACOUSTIC, in general, denotes any thing that relates to the ear, the sense of hearing, or the doctrine of sounds.

Acoustic Duct, in *Anatomy*, the same with *meatus auditorius*, or the external passage of the ear. See ANATOMY.

Acoustic Instrument, or auricular tube. See ACOUSTICS.

Acoustic Vessels, in the ancient theatres, were a kind of vessels made of brass, shaped in the bell fashion, which being of all tones within the pitch of the voice, or even of instruments, rendered the sound more audible, so that the actors could be heard through all parts of theatres which were even 400 feet in diameter.

Acoustic Disciples, among the ancient Pythagoreans, those more commonly called ACOUSMATICI.

ACOUSTICS,

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IN *Physics*, is that science which instructs us in the nature of sound. It is divided by some writers into *Diacoustics*, which explains the properties of those sounds that come directly from the sonorous body to the ear; and *Catacoustics*, which treats of reflected sounds: but such distinctions do not appear to be of any real utility.

Sound is a term of which it would be preposterous to offer any definition, as it may almost be said to express a simple idea: But when we consider it as a SENSATION, and still more when we consider it as a PER-

CEPTION, it may not be improper to give a description of it; because this must involve certain relations of external things, and certain trains of events in the material world, which make it a proper object of philosophical discussion. Sound is that primary information which we get of external things by means of the sense of hearing. This, however, does not explain it; for were we in like manner to describe our sense of hearing, we should find ourselves obliged to say, that it is the faculty by which we perceive sound. Languages are not the invention of philosophers; and we must not expect

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expect precision, even in the simplest cases. Our methods of expressing the information given us by our different senses are not similar, as a philosopher, cautiously contriving language, would make them. We have no word to express the primary or generic object of our sense of seeing; for we believe, that even the vulgar consider light as the medium, but not the object. This is certainly the case (how justly we do not say) with the philosopher. On the other hand, the words smell, sound, and perhaps taste, are conceived by most persons as expressing the immediate objects of the senses of smelling, hearing, and tasting. Smell and sound are hastily conceived as separate existences, and as mediums of information and of intercourse with the odoriferous and sounding bodies; and it is only the very cautious philosopher who distinguishes between the smell which he feels and the perfume which fills the room. Those of the ancients, therefore, who taught that sounds were beings wafted through the air, and felt by our ears, should not, even at this day, be considered as awkward observers of nature. It has required the long, patient, and sagacious consideration of the most penetrating geniuses, from Zeno the Stoic to Sir Isaac Newton, to discover that what we call sound, the *immediate* external object of the sense of hearing, is nothing but a particular agitation of the parts of surrounding bodies, acting by mechanical impulse on our organs; and that it is not any separate being, nor even a specific quality inherent in any particular thing, by which it can affect the organ, as we suppose with respect to a perfume, but merely a mode of existence competent to every atom of matter. And thus the description which we proposed to give of sound must be a description of that state of external contiguous matter which is the *cause* of sound. It is not therefore prefatory to any theory or set of doctrines on this subject: but on the contrary, is the sum or result of them all.

To discover this state of the external body by which, without any farther intermedium of substance or of operation, it affects our sensitive faculties, must be considered as a great step in science. It will show us at least one way by which mind and body may be connected. It is supposed that we have attained this knowledge with respect to sound. Our success, therefore, is a very pleasing gratification to the philosophic mind. It is still more important in another view: it has encouraged us to make similar attempts in other cases, and has supplied us with a fact to which an ingenious mind can easily fancy something analogous in many abstruse operations of nature, and thus it enables us to give some sort of explanation of them. Accordingly this use has been most liberally made of the mechanical theory of sound; and there is now scarcely any phenomenon, either of matter or mind, that has not been explained in a manner somewhat similar. But we are sorry to say that these explanations have done no credit to philosophy. They are, for the most part, strongly marked with that precipitate and self-conceited impatience which has always characterised the investigations conducted solely by ingenious fancy. The consequences of this procedure have been no less fatal to the progress of true knowledge in modern times than in the schools of ancient Greece; and the ethereal philosophers of this age, like the followers of Aristotle of old, have filled ponderous volumes with nonsense

and error. It is strange, however, that this should be the effect of a great and successful step in philosophy: But the fault is in the philosophers, not in the science. Nothing can be more certain than the account which Newton has given of the propagation of a certain class of undulations in an elastic fluid. But this procedure of nature cannot be seen with distinctness and precision by any but well-informed mathematicians. They alone can rest with unshaken confidence on the conclusions legitimately deduced from the Newtonian theorems; and even they can insure success only by treading with the most scrupulous caution the steps of this patient philosopher. But few have done this; and we may venture to say, that not one in ten of those who employ the Newtonian doctrines of elastic undulations for the explanation of other phenomena have taken the trouble, or indeed were able, to go through the steps of the fundamental proposition (Prin. II. 50. &c.) But the *general* results are so plain, and admit of such impressive illustration, that they draw the assent of the most careless reader; and all imagine that they understand the explanation, and perceive the whole procedure of nature. Emboldened therefore by this successful step in philosophy, they, without hesitation, *fancy* similar intermediums in other cases; and as air has been found to be a vehicle for sound, they have supposed that something which they call ether, somehow resembling air, is the vehicle of vision. Others have proceeded farther, and have held that ether, or another something like air, is the vehicle of sensation in general, from the organ to the brain: nay, we have got a great volume called A THEORY OF MAN, where all our sensations, emotions, affections, thoughts, and purposes or volitions, are said to be so many vibrations of another something equally unseen, gratuitous, and incompetent; and to crown all, this exalted doctrine, when logically prosecuted, must terminate in the discovery of those vibrations which pervade all others, and which constitute what we have been accustomed to venerate by the name DEITY. Such *must* be the termination of this philosophy; and a truly philosophical dissertation on the attributes of the Divine Being *can be nothing else* than an accurate description of these vibrations!

This is not a needless and declamatory rhapsody. If the explanation of sound can be legitimately transferred to those other classes of phenomena, these are certain results; and if so, all the discoveries made by Newton are but the glimmerings of the morning, when compared with this meridian splendour. But if, on the other hand, sound logic forbids us to make this transference of explanation, we must continue to believe, for a little while longer, that mind is something different from vibrating matter, and that no kind of oscillations will constitute infinite wisdom.

It is of immense importance therefore to understand thoroughly this doctrine of sound, that we may see clearly and precisely in what it consists, what are the phenomena of sound that are fully explained, what are the data and the assumptions on which the explanations proceed, and what is the *precise mechanical fact* in which it terminates. For this, or a fact perfectly similar, must terminate every explanation which we derive from this by analogy, however perfect the analogy may be. This *previous* knowledge must be completely possessed.

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sessed by every person who pretends to explain other phenomena in a similar manner. Then, and not till then, he is able to say what classes of phenomena will admit of the explanation: and, when all this is done, his explanation is still an *hypothesis*, till he is able to prove, from other indisputable sources, the existence and agency of the same thing analogous to the elastic fluid, from which all is borrowed.

At present therefore we shall content ourselves with giving a short history of the speculations of philosophers on the nature of sound, tracing out the steps by which we have arrived at the knowledge which we have of it. We apprehend this to be of great importance; because it shows us what kind of evidence we have for its truth, and the paths which we must shun if we wish to proceed farther: and we trust that the progress which we have made will appear to be so real, and the object to be attained so alluring to a truly philosophical mind, that men of genius will be incited to exert their utmost efforts to pass the present boundaries of our real progress.

First notions of sound.

In the infancy of philosophy, sound was held to be a separate existence, something which would be, although no hearing animal existed. This was conceived as wafted through the air to our organ of hearing, which it was supposed to affect in a manner resembling that in which our nostrils are affected when they give us the sensation of smell. It was one of the Platonic SPECIES, fitted for exciting the intellectual species, which is the immediate object of the soul's contemplation.

Yet, even in those early years of science, there were some, and, in particular, the celebrated founder of the Stoic school, who held that sound, that is, the cause of sound, was only the particular motion of external gross matter, propagated to the ear, and there producing that agitation of the organ by which the soul is immediately affected with the sensation of sound. Zeno, as quoted by Diogenes Laertius*, says, "Hearing is produced by the air which intervenes between the thing sounding and the ear. The air is agitated in a spherical form, and moves off in waves; and falls on the ear, in the same manner as the water in a cistern undulates in circles when a stone has been thrown into it." The ancients were not remarkable for precision, either of conception or argument, in their discussions, and they were contented with a general and vague view of things. Some followed the Platonic notions, and many the opinion of Zeno, but without any further attempts to give a distinct conception of the explanation, or to compare it with experiment.

Zeno's opinion.
* B. vii.
§ 158.

Air the vehicle of sound proved by the air-pump.

But in later times, during the ardent researches in the last century into the phenomena of nature, this became an interesting subject of inquiry. The invention of the air-pump gave the first opportunity of deciding by experiment whether the elastic undulations of air were the causes of sound: and the trial fully established this point; for a bell rung *in vacuo* gave no sound, and one rung in condensed air gave a very loud one. It was therefore received as a doctrine in general physics, that air was the vehicle of sound.

Galileo's discovery of the nature of musical chords.

The celebrated Galileo, the parent of mathematical philosophy, discovered the nature of that connexion between the lengths of musical chords and the notes which they produced, which had been observed by Pythagoras,

or learned by him in his travels in the east, and which he made the foundation of a refined and beautiful science, the theory of music. Galileo showed, that the real connexion subsisted between the tones and the vibrations of these chords, and that their different degrees of acuteness corresponded to the different frequency of their vibrations. The very elementary and familiar demonstration which he gave of this connexion did not satisfy the curious mathematicians of that inquisitive age; and the mechanical theory of musical chords was prosecuted to a great degree of refinement. In the course of this investigation, it appeared that the chord vibrated in a manner precisely similar to a pendulum vibrating in a cycloid. It must therefore agitate the air contiguous to it in the same manner; and thus there is a particular kind of agitation which the air *can* receive and maintain, which is very interesting.

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Sir Isaac Newton took up this question as worthy of his notice; and endeavoured to ascertain with mathematical precision the mechanism of this particular class of undulations, and gave us the fundamental theorems concerning the undulations of elastic fluids, which make the 47th, &c. propositions of Book II. of the Principles of Natural Philosophy. They have been (perhaps hastily) considered as giving the fundamental doctrines concerning the propagation of sound. A variety of facts are narrated in the article PNEUMATICS, to show that such undulations *actually obtain* in the air of our atmosphere, and are accompanied by a set of phenomena of sound which precisely correspond to all the mechanical circumstances of these undulations.

corresponds with the phenomena of sound.

In the mean time, the anatomists and physiologists were busily employed in examining the structure of our organs of hearing. Impressed with the validity of this doctrine of aerial undulations being the cause of sound, their researches were always directed with a view to discover those circumstances in the structure of the ear which rendered it an organ susceptible of agitations from this cause; and they discovered many which appeared as contrivances for making it a drum, on which the aerial undulations from without must make very forcible impulses, so as to produce very sonorous undulations in the air contained in it. These therefore they considered as the *immediate* objects of sensation, or the immediate causes of sound.

Researches of anatomists.

But some anatomists saw that this would not be a full account of the matter: for after a drum is agitated, it has done all that it can do; it has produced a noise. But a farther process goes on in our ear: There is behind the membrane, which is the head of this drum, a curious mechanism, which communicates the agitations of the membrane (the only thing acted on by the undulating air) to another chamber of most singular construction, where the auditory nerve is greatly expanded. They conceive, therefore, that the organ called the *drum* does not act as a drum, but in some other way. Indeed it seems bad logic to suppose that it acts as a drum merely by producing a noise. This is in no respect different from the noise produced out of the ear; and if it is to be heard as a noise, we must have another ear by which it may be heard, and this ear must be another *such* drum; and this must have another, and so on for ever. It is like the inaccurate notion that vision is the contemplation of the picture on the retina. These anatomists attended therefore to the structure. Here they observed

Structure of the ear.

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nary
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tions. observed a prodigious unfolding of the auditory nerve of the ear, which is curiously distributed through every part of this cavity, lining its sides, hung across it like a curtain, and sending off fibres in every direction, so as to leave hardly a point of it unoccupied. They thought the machinery contained in the drum peculiarly fitted for producing undulations of the air contained in this labyrinth, and that by these agitations of the air the contiguous fibres of the auditory nerve are impelled, and that thus we get the sensation of sound.

f the hu-
an. The cavity intervening between the external ear and this inner chamber appeared to these anatomists to have no other use than to allow a very free motion to the *stapes* or little piston that is employed to agitate the air in the labyrinth. This piston condenses on a very small surface the impulse which it receives from a much larger surface, strained by the malleus on the entry of the tympanum, on purpose to receive the gentle agitations of the external air in the outer canal. This membranous surface could not be agitated, unless completely detached from every thing round it; therefore all animals which have this mechanism have it in a cavity containing only air. But they held, that nature had even taken precautions to prevent this cavity from acting as a drum, by making it of such an irregular rambling form; for it is by no means a cavity of a symmetrical shape, like a vessel, but rather resembles the rambling holes and blebs which are often seen in a piece of bread, scattered through the substance of the cranium, and communicating with each other by small passages. The whole of these cavernulæ are lined with a softish membrane, which still farther unfits this cavity for producing sound. This reasoning is specious, but not very conclusive. We might even assert, that this anfractuous form, with narrow passages, is well fitted for producing noise. If we place the ear close to the small hole in the side of a military drum, we shall hear the smallest tap of the drumstick like a violent blow. The lining of the cavernulæ is nervous, and may therefore be strongly affected in the numerous narrow passages between the cells.

f other
animals. While these speculations were going on with respect to the ear of the breathing animals, observations were occasionally made on other animals, such as reptiles, serpents, and fishes, which give undoubted indications of hearing; and many very familiar facts were observed or recollected, where sounds are communicated through or by means of solid bodies, or by water: therefore, without inquiring how or by what kind of mechanism it is brought about, it became a very general belief among physiologists, that all fishes, and perhaps all animals, hear, and that water in particular is a vehicle of sound. Many experiments are mentioned by Kircher and others on the communication of sound through solid bodies, such as masts, yards, and other long beams of dry fir, with similar results. Dr. *Monro* has published a particular account of very curious experiments on the propagation of sound through water in his *Dissertation on the Physiology of Fishes*; so that it now appears that air is by no means the only vehicle of sound.

f water dis-
covered in
the internal
ear. In 1760 *Cotuni* published his important discovery, that the labyrinth or inmost cavity of the ear in animals is completely filled with water. This, after some contest, has been completely demonstrated (see in VOL. I. Part I. †

particular *Meckel Junior de Labyrinthi Auris Contem- Preliminary*
tis, Argentor. 1777), and it seems now to be admitted Observa-
by all. tions.

This being the case, our notions of the immediate cause of sound must undergo a great revolution, and a new research must be made into the way in which the nerve is affected: for it is not enough that we substitute the undulations of water for those of air in the labyrinth. The well-informed mechanician will see at once, that the vivacity of the agitations of the nerve will be greatly increased by this substitution; for if water be perfectly elastic through the whole extent of the undulatory agitation which it receives, its effect will be greater in proportion to its specific gravity: and this is confirmed by an experiment very easily made. Immerse a table-bell in water contained in a large thin glass vessel. Strike it with a hammer. The sound will be heard as if the bell had been immediately struck on the sides of the vessel. The filling of the labyrinth of the ear with water is therefore an additional mark of the wisdom of the Great Artist. But this is not enough for informing us concerning the ultimate mechanical event in the process of hearing. The manner in which the nerve is exposed to these undulations must be totally different from what was formerly imagined. The filaments and membranes, which have been described by former anatomists, must have been found by them in a state quite unlike to their situation and condition in the living animal. Accordingly the most eminent anatomists of Europe seem at present in great uncertainty as to the state of the nerve, and are keenly occupied in observations to this purpose. The descriptions given by *Monro*, *Scarpa*, *Camper*, *Comparetti*, and others, are full of most curious discoveries, which make almost a total change in our notions of this subject, and will, we hope, be productive of most valuable information.

Increases
the force of
the undula-
tions. Scarpa has discovered that the solid cavity called the *Scarpa's*
labyrinth contains a threefold expansion of the auditory discovery of
nerve. One part of it, the cochlea, contains it in a fi- the expan-
brillous state, ramified in a most symmetrical manner sion of the
through the whole of the *zona mollis* of the *lamina spi- labyrinth.*
ralis, where it anastomoses with another production of it diffused over the general lining of that cavity. Another department of the nerve, also in a fibrous state, is spread over the external surface of a membranaceous bag, which nearly fills that part of the vestibule into which the semicircular canals open, and also that orifice which receives the impressions of the *stapes*. This bag sends off tubular membranaceous ducts, which, in like manner, nearly fill these semicircular canals. A third department of the nerve is spread over the external surface of another membranaceous bag, which lies between the one just now mentioned and the cochlea, but having no communication with either, almost completely filling the remainder of the vestibule. Thus the vestibule and canal seem only a case for protecting this sensitive membranaceous vessel, which is almost, but not altogether, in contact with the osseous case, being separated by a delicate and almost fluid cellular substance. The fibrillous expansion of the nerve is not indiscriminately diffused over the surface of these sacculi, but evidently directed to certain foci, where the fibres are constipated. And this is the last appearance of the fibrous state of the nerve; for when the inside of these sacculi is inspected, no fibres appear, but a pulp (judged to be nervous from

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from its similarity to other pulpy productions of the brain) adhering to the membranaceous coat, and not separable from it by gently washing it. It is more abundant, that is, of greater thickness, opposite to the external fibrous foci. No organical structure could be discovered in this pulp, but it probably is organised; for, besides this adhering pulp, the water in the sacculi was observed to be clammy or mucous; so that in all probability the vascular or fibrous state of the nerve is succeeded by an uninterrupted production (perhaps columnar like basalt, though not cohering); and this at last ends in simple dissemination, symmetrical however, where water and nerve are alternate in every direction.

Comparetti's, of a tympanum in the foramen rotundum.

To these observations of Scarpa, Comparetti adds the curious circumstance of another and regular tympanum in the foramen rotundum, the cylindric cavity of which is enclosed at both ends by a fine membrane. The membrane which separates it from the cochlea appears to be in a state of variable tension, being drawn up to an umbo by a cartilaginous speck in its middle, which he thinks adheres to the lamina spiralis, and thus serves to strain the drumhead, as the malleus strains the great membrane known to all.

These are most important observations, and must greatly excite the curiosity of a truly philosophical mind, and deserve the most careful inquiry into their justness. If these are accurate descriptions of the organ, they seem to conduct us farther into the secrets of nature than any thing yet known.

We think that they promise to give us the greatest step yet made in physiology, viz. to show us the last mechanical fact which occurs in the long train interposed between the external body and the incitement of our sensitive system. But there are, as yet, great and essential differences in the descriptions given by those celebrated naturalists. It cannot be otherwise. The containing labyrinth can be laid open to our view in no other way than by destroying it; and its most delicate contents are the first sufferers in the search. They are found in very different situations and conditions by different anatomists, according to their address or their good fortune. Add to this, that the natural varieties are very considerable. Faithful descriptions must therefore give very different notions of the ultimate action and reaction between the unorganized matter in the labyrinth and the ultimate expansion of the auditory nerve.

The progress which has been made in many parts of natural science has been great and wonderful; and perhaps we are not too sanguine, when we express our hopes that the observations and experiments of anatomists and mechanicians will soon furnish us with such a collection of facts respecting the structure and the contents of the organ of hearing, as might enable us to give a juster theory of sound than is yet to be found in the writings of philosophers. There seems to be no abatement of ardour in the researches of the physiologists; and they will not remain long ignorant of the truth or mistake in the accounts given by Scarpa and Comparetti. A collection of accurate observations on the structure of the ear would give us principles on which to proceed in explaining the various methods of producing external sounds. The nature of *continued sounds* might then be treated of, and would appear, we believe, very different from

what it is commonly supposed. Under this head animal voices might be particularly considered, and the elements of human speech properly ascertained. When the production of continued sounds is once shown to be a thing regulated by principle, it may be systematically treated, and this principle may be considered as combined with every mechanical state of body that may be pointed out. This will suggest to us methods of producing sound which have not yet been thought of, and may therefore give us sounds with which we are unacquainted. Such an acquisition is not to be despised nor rejected. The bountiful Author of our being and of all our faculties has made it an object of most enchanting relish to the human mind. The Greeks, the most cultivated people who have ever figured on the stage of life, enjoyed the pleasures of music with rapture. Even the poor negro, after toiling a whole day beneath a tropical sun, will go ten miles in the dark to dance all night to the simple music of the balafoe, and return without sleep to his next day's toil. The penetrating eye of the anatomist has discovered in the human larynx an apparatus evidently contrived for tempering the great movements of the glottis, so as to enable us to produce the intended note with the utmost precision. There is no doubt therefore that the consummate Artist has not thought it unworthy of his attention. We ought therefore to receive with thankfulness this present from our Maker—this *laborum dulce lenimen*; and it is surely worthy the attention of the philosopher to add to this innocent elegance of life.

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CHAP. I. *Different Theories of Sound.*

MOST sounds, we all know, are conveyed to us on the bosom of the air. In whatever manner they either float upon it, or are propelled forward in it, certain it is, that, without the vehicle of this or some other fluid, we should have no sounds at all. Let the air be exhausted from a receiver, and a bell shall emit no sound when rung in the void; for, as the air continues to grow less dense, the sound dies away in proportion, so that at last its strongest vibrations are almost totally silent.

Thus air is a vehicle for sound. However, we must not, with some philosophers assert, that it is the only vehicle; that, if there were no air, we should have no sounds whatsoever: for it is found by experiment, that sounds are conveyed through water with the same facility with which they move through air. A bell rung in water returns a tone as distinct as if rung in air. This was observed by Derham, who also remarked that the tone came a quarter deeper. It appears, from the experiments of naturalists, that fishes have a strong perception of sounds, even at the bottom of deep rivers. From hence, it would seem not to be very material in the propagation of sounds, whether the fluid which conveys them be elastic or otherwise. Water, which, of all substances that we know, has the least elasticity, yet serves to carry them forward; and if we make allowance for the difference of its density, perhaps the sounds move in it with a proportional rapidity to what they are found to do in the elastic fluid of air. But though air and water are both vehicles of sound, yet neither of them according to some philosophers seems

Of the vehicles of sound.

Air not the only one.

Different
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to be so by itself, but only as it contains an exceedingly subtle fluid capable of penetrating the most solid bodies. Hence, by the medium of that fluid, sounds can be propagated through wood, or metals, even more readily than through the open air. By the same means, deaf people may be made sensible of sounds if they hold a piece of metal in the mouth, one end of which is applied to the sounding body. And as it is certain, that air cannot penetrate metals, the medium of sound, say they, must be of a more subtle nature; and thus the electrical fluid will naturally occur as the proper one. But why then is sound no longer heard in an exhausted receiver, if the air is not the fluid by which it is conveyed, seeing the electrical matter cannot be excluded? The reply to this is obvious: The electrical fluid is so exceedingly subtle, and pervades solid bodies with so much ease, that any motion of a solid body in a quantity of electric matter by itself, can never excite a degree of agitation in it sufficient for producing a sound; but if the electric fluid is entangled among the particles of air, water, wood, metal, &c. whatever affects their particles will also affect this fluid, and produce an audible noise. In the experiment of the air-pump, it is alleged there may be an ambiguity, as the gradual exhausting of the air creates an increasing difference of pressure on the outside, and may occasion in the glass a difficulty of vibrating, so as to render it less fit to communicate to the air without the vibrations that strike it from within. From this cause the diminution of sound in an exhausted receiver may be supposed to proceed, as well as from the diminution of the air. But if any internal agitation of its parts should happen to the electrical fluid, exceeding loud noises might be propagated through it, as has been the case when large meteors have kindled at a great distance from the earth. It is also difficult, they suppose, to account for the amazing velocity of sound, upon the supposition that it is propagated by means of air alone; for nothing is more certain, than that the strongest and most violent gale is, in its course, inert and sluggish, compared with the motion of sound.

What sound
, and how
propagated.

One thing however is certain, that whether the fluid which conveys the note be elastic, or nonelastic, whatever sound we hear is produced by a stroke, which the sounding body makes against the fluid, whether air or water. The fluid being struck upon, carries the impression forward to the ear, and there produces its sensation. Philosophers are so far agreed, that they all allow that sound is nothing more than the impression made by an elastic body upon the air or water, and this impression carried along by either fluid to the organ of hearing. But the manner in which this conveyance is made, is still disputed: Whether the sound is diffused into the air, in circle beyond circle, like the waves of water when we disturb the smoothness of its surface by dropping in a stone; or whether it travels along, like rays diffused from a centre, somewhat in the swift manner that electricity runs along a rod of iron; these are the questions which have divided the learned.

Newton's
theory.

Newton was of the first opinion. He has explained the progression of sound by an undulatory, or rather a vermicular, motion in the parts of the air. If we have an exact idea of the crawling of some insects, we shall have a tolerable notion of the progression of sound upon

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this hypothesis. This insect, for instance, in its motion, first carries its contractions from the hinder part, in order to throw its fore part to the proper distance, then it carries its contractions from the fore part to the hinder to bring that forward. Something similar to this is the motion of the air when struck upon by a sounding body. To be a little more precise, suppose ABC, Plate I. fig. 1. the striking of a harpsichord screwed to a proper pitch, and drawn out of the right line by the finger at B. We shall have occasion elsewhere to observe, that such a string would, if let go, vibrate to E; and from E to D, and back again; that it would continue thus to vibrate like a pendulum, for ever, if not externally resisted, and, like a pendulum, all its little vibrations would be performed in equal times, the last and the first being equally long in performing; also that, like a pendulum, its greatest swiftness would always be when it arrived at E, the middle part of its motion. Now then, if this string be supposed to fly from the finger at B, it is obvious, that whatever be its own motion, such also will be the motion of the parts of air that fly before it. Its motion, as is obvious, is first uniformly accelerated forward from B to E, then retarded as it goes from E to D, accelerated back again as it returns from D to E, and retarded from E to B. This motion being therefore successively produced through a range of elastic air, it must happen, that the parts of one range of air will be sent forward with accelerated motion, and then with a retarded motion. This accelerated motion reaching the remotest end of the first range will be communicated to a second range, whilst the nearest parts of the first range being retarded in their motion, and falling back with the recession of the string, retire first with an accelerated, then with a retarded motion, and the remotest parts will soon follow. In the mean time, while the parts of the first range are thus falling back, the parts of the second range are going forward with an accelerated motion. Thus there will be an alternate condensation and relaxation of the air, during the time of one vibration; and as the air going forward strikes any opposing body with greater force than upon retiring, so each of these accelerated progressions has been called by Newton a *pulse* of sound.

Thus will the air be driven forward in the direction of the string. But now we must observe, that these pulses will move every way; for all motion impressed upon fluids in any direction whatsoever, operates all around in a sphere: so that sounds will be driven in all directions, backwards, forwards, upwards, downwards, and on every side. They will go on succeeding each other, one on the outside of the other, like circles in disturbed water; or rather, they will lie one without the other, in concentric shells, shell above shell, as we see in the coats of an onion.

All who have remarked the tone of a bell, while its sounds are decaying away, must have an idea of the pulses of sound, which, according to Newton, are formed by the air's alternate progression and recession. And it must be observed, that as each of these pulses is formed by a single vibration of the string, they must be equal to each other; for the vibrations of the string are known to be so.

Again, As to the velocity with which sounds travel, this Newton determines, by the most difficult calculation

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tion that can be imagined, to be in proportion to the thickness of the parts of the air, and the distance of these parts from each other. From hence he goes on to prove, that each little part moves backward and forward like a pendulum; and from thence he proceeds to demonstrate, that if the atmosphere were of the same density everywhere as at the surface of the earth, in such a case, a pendulum, that reached from its highest surface down to the surface of the earth, would by its vibrations discover to us the proportion of the velocity with which sounds travel. The velocity with which each pulse would move, he shows, would be as much greater than the velocity of such a pendulum swinging with one complete vibration, as the circumference of a circle is greater than the diameter. From hence he calculates, that the motion of sound will be 979 feet in one second. But this not being consonant to experience, he takes in another consideration, which destroys entirely the rigour of his former demonstration, namely, vapours in the air; and then finds the motion of sound to be 1142 feet in one second, or near 13 miles in a minute; a proportion which experience had established nearly before.

Preceding
theory op-
posed.

This much will serve to give an obscure idea of a theory which has met with numerous opposers. Even John Bernoulli, Newton's greatest disciple, modestly owns that he did not pretend to understand this part of the *Principia*. He attempted therefore to give a more perspicuous demonstration of his own, that might confirm and illustrate the Newtonian theory. The subject seemed to reject elucidation; his theory is obviously wrong, as D'Alembert has proved in his *Theory of Fluids*.

The objec-
tions.

Various have been the objections that have been made to the Newtonian system of sounds. It is urged, that this theory can only agree with the motion of sound in an elastic fluid, whereas sounds are known to move forward through water that is not elastic. To explain their progress therefore through water, a second theory must be formed; so that two theories must be made to explain a similar effect; which is contrary to the simplicity of true philosophy, for it is contrary to the simplicity of nature. It is further urged, that this slow vermicular motion but ill represents the velocity with which sounds travel, as we know by experience that it is almost 13 miles in a minute. In short, it is urged, that such undulations as have been described, when coming from several sonorous bodies at once, would cross, obstruct, and confound each other; so that, if they were conveyed to the ear by this means, we should hear nothing but a medley of discord and broken articulations. But this is equally with the rest contradictory to experience, since we hear the fullest concert, not only without confusion, but with the highest pleasure. These objections, whether well founded or not, have given rise to another theory: which we shall likewise lay before the reader; though it too appears liable to objections, which shall be afterwards mentioned.

Another
theory.

Every sound may be considered as driven off from the sounding body in straight lines, and impressed upon the air in one direction only: but whatever impression is made upon a fluid in one direction, is diffused upon its surface into all directions: so that the sound first driven directly forward soon fills up a wide sphere, and

is heard on every side. Thus, as it is impressed, it instantaneously travels forward with a very swift motion, resembling the velocity with which we know electricity flies from one end of a line to another.

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Now, as to the pulses, or close shakes as the musicians express it, which a sounding body is known to make, each pulse (say the supporters of this theory) is itself a distinct and perfect sound, and the interval between every two pulses is profoundly silent. Continuity of sound from the same body is only a deception of the hearing; for as each distinct sound succeeds at very small intervals, the organ has no time to transmit its images with equal swiftness to the mind, and the interval is thus lost to sense: just as in seeing a flaming torch, whirled rapidly round, it appears as a ring of fire. In this manner a beaten drum, at some small distance, presents us with the idea of continuing sound. When children run with their sticks along a rail, a continuing sound is thus represented, though it need scarce be observed that the stroke against each rail is perfectly distinct and insulated.

According to this theory, therefore, the pulses are nothing more than distinct sounds repeated by the same body, the first stroke or vibration being ever the loudest, and travelling farther than those that follow; while each succeeding vibration gives a new sound, but with diminished force, till at last the pulses decay away totally, as the force decays that gives them existence.

All bodies whatsoever that are struck return more or less a sound: but some, wanting elasticity, give back no repetition of the sound; the noise is at once produced and dies: while other bodies, however, there are, which being more elastic and capable of vibration, give back a sound, and repeat the same several times successively. These last are said to have a tone; the others are not allowed to have any.

This tone of the elastic string, or bell, is notwithstanding nothing more than a similar sound of what the former bodies produced, but with the difference of being many times repeated, while their note is but single. So that, if we would give the former bodies a tone, it will be necessary to make them repeat their sound, by repeating our blows swiftly upon them. This will effectually give them a tone; and even an unmusical instrument has often had a fine effect by its tone in our concerts.

Let us now go on then to suppose, that by swift and equably continued strokes we give any nonelastic body its tone; it is very obvious, that no alterations will be made in this tone by the quickness of the strokes, though repeated ever so fast. These will only render the tone more equal and continuous, but make no alteration in the tone it gives. On the contrary, if we make an alteration in the force of each blow, a different tone will then undoubtedly be excited. The difference will be small, it must be confessed; for the tones of these inflexible bodies are capable but of small variation; however, there will certainly be a difference. The table on which we write, for instance, will return a different sound when struck with a club, from what it did when struck only with a switch. Thus nonelastic bodies return a difference of tone, not in proportion to the swiftness with which their sound is repeated, but in proportion to the greatness of the blow which produced it; for in two equal nonelastic bodies, that body produced

Different theories of greatest blow. Sound.

Different Theories of Sound.

We now then come to a critical question, What is it that produces the difference of tone in two elastic sounding bells or strings? or, what makes one deep and the other shrill? This question has always been hitherto answered by saying, that the depth or height of the note proceeded from the slowness or swiftness of the times of the vibrations. The slowest vibrations, it has been said, are qualified for producing the deepest tones, while the swiftest vibrations produce the highest tones. In this case, an effect has been given for a cause. It is in fact the force with which the sounding string strikes the air when struck upon, that makes the true distinction in the tones of sound. It is this force, with greater or less impressions, resembling the greater or less force of the blows upon a nonelastic body, which produces correspondent affections of sound. The greatest forces produce the deepest sounds; the high notes are the effect of small efforts. In the same manner a bell, wide at the mouth, gives a grave sound; but if it be very massy withal, that will render it still graver; but if massy, wide, and long or high, that will make the tone deepest of all.

Thus, then, will elastic bodies give the deepest sound in proportion to the force with which they strike the air: but if we should attempt to increase their force by giving them a stronger blow, this will be in vain; they will still return the same tone; for such is their formation, that they are sonorous only because they are elastic, and the force of this elasticity is not increased by our strength, as the greatness of a pendulum's vibrations will not be increased by falling from a greater height.

Now as to the frequency with which elastic strings vibrate the deepest tones, it has been found, that the longest strings have the widest vibrations, and consequently go backward and forward slowest; while, on the contrary, the shortest strings vibrate the quickest, or come and go in the shortest intervals. From hence those who have treated of sounds have asserted, as was said before, that the tone of the string depended upon the length or the shortness of the vibrations. This, however, is not the case. One and the same string, when struck, must always, like the same pendulum, return precisely similar vibrations: but it is well known, that one and the same string, when struck upon, does not always return precisely the same tone: so that in this case the vibrations follow one rule, and the tone another. The vibrations must be invariably the same in the same string, which does not return the same tone invariably, as is well known to musicians in general. In the violin, for instance, they can easily alter the tone of the string an octave or eight notes higher, by a softer method of drawing the bow; and some are known thus to bring out the most charming airs imaginable. These peculiar tones are by the English fiddlers called *flute-notes*. The only reason, it has been alleged, that can be assigned for the same string thus returning different tones, must certainly be the different force of its strokes upon the air. In one case, it has double the tone of the other:

because upon the soft touches of the bow, only half its elasticity is put into vibration.

This being understood (continue the authors of this theory), we shall be able clearly to account for many things relating to sounds that have hitherto been inexplicable. Thus, for instance, if it be asked, When two strings are stretched together of equal lengths, tensions, and thickness, how does it happen, that one of them being struck, and made to vibrate throughout, the other shall vibrate throughout also? The answer is obvious: The force that the string struck receives is communicated to the air, and the air communicates the same to the similar string; which therefore receives all the force of the former; and the force being equal, the vibrations must be so too. Again: Put the question, If one string be but half the length of the other, and be struck, how will the vibrations be? The answer is, The longest string will receive all the force of the string half as long as itself, and therefore it will vibrate in proportion, that is, through half its length. In the same manner, if the longest string were three times as long as the other, it would only vibrate in a third of its length; or if four times, in a fourth of its length. In short, whatever force the smaller string impresses upon the air, the air will impress a similar force upon the longer string, and partially excite its vibrations.

From hence also we may account for the cause of those Eolian charming melancholy gradations of sound in the Eolian Lyre, Plate I. fig. 2.; an instrument (says Sir John Hawkins) lately obtruded upon the public as a new invention, though described above a century ago by Kircher*. * Vid. Kircher's Musurgia. lib. ix. This instrument is easily made, being nothing more than a long narrow box of thin deal, about 30 inches long, 5 inches broad, and $1\frac{1}{2}$ inches deep, with a circle in the middle of the upper side or belly about $1\frac{1}{2}$ inch diameter pierced with small holes. On this side are seven, ten, or (according to Kircher) fifteen or more strings of very fine gut, stretched over bridges at each end, like the bridge of a fiddle, and screwed up or relaxed with screw-pins (B). The strings are all tuned to one and the same note; and the instrument is placed in some current of air, where the wind can brush over its strings with freedom. A window with the sash just raised to give the air admission will answer this purpose exactly. Now when the entering air blows upon these strings with different degrees of force, there will be excited different tones of sound; sometimes the blast brings out all the tones in full concert; sometimes it sinks them to the softest murmurs; it feels for every tone, and by its gradations of strength solicits those gradations of sound which art has taken different methods to produce.

It remains, in the last place, to consider (by this theory) the loudness and lowness, or, as the musicians speak, the strength and softness of sound. In vibrating elastic strings, the loudness of the tone is in proportion to the deepness of the note; that is, in two strings, all things in other circumstances alike, the deepest tone will be loudest. In musical instruments upon a different principle, as in the violin, it is otherwise;

(B) The figure represents the instrument with ten chords; of which some direct only eight to be tuned unisons, and the two outermost octaves below them. But this seems to be not material.

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wise; the tones are made in such instruments, by a number of small vibrations crowded into one stroke. The rosined bow, for instance, being drawn along a string, its roughnesses catch the string at very small intervals, and excite its vibrations. In this instrument, therefore, to excite loud tones, the bow must be drawn quick, and this will produce the greatest number of vibrations. But it must be observed, that the more quick the bow passes over the string, the less apt will the roughness of its surface be to touch the string at every instant; to remedy this, therefore, the bow must be pressed the harder as it is drawn quicker, and thus its fullest sound will be brought from the instrument. If the swiftness of the vibrations in an instrument thus rubbed upon, exceed the force of the deeper sound in another, then the swift vibrations will be heard at a greater distance, and as much farther off as the swiftness in them exceeds the force in the other.

The nature
of musical
sounds il-
lustrated
according
to the same
theory.

By the same theory (it is alleged) may all the phenomena of musical sounds be easily explained.—The fables of the ancients pretend, that music was first found out by the beating of different hammers upon the smith's anvil. Without pursuing the fable, let us endeavour to explain the nature of musical sounds by a similar method. Let us suppose an anvil, or several similar anvils, to be struck upon by several hammers of different weights or forces. The hammer, which is double that of another, upon striking the anvil will produce a sound double that of the other: this double sound musicians have agreed to call an octave. The ear can judge of the difference or resemblance of these sounds with great ease, the numbers being as one and two, and therefore very readily compared. Suppose that a hammer, three times less than the first, strikes the anvil, the sound produced by this will be three times less than the first: so that the ear, in judging the similitude of these sounds, will find somewhat more difficulty; because it is not so easy to tell how often one is contained in three, as it is to tell how often it is contained in two. Again, Suppose that a hammer four times less than the first strikes the anvil, the ear will find greater difficulty still in judging precisely the difference of the sounds; for the difference of the numbers four and one cannot so soon be determined with precision as three and one. If the hammer be five times less, the difficulty of judging will be still greater. If the hammer be six times less, the difficulty still increases, and so also of the seventh, so that the ear cannot always readily and at once determine the precise gradation. Now, of all comparisons, those which the mind makes most easily, and with least labour, are the most pleasing. There is a certain regularity in the human soul, by which it finds happiness in exact and striking, and easily made comparisons. As the ear is but an instrument of the mind, it is therefore most pleased with the combination of any two sounds, the difference of which it can most readily distinguish. It is more pleased with the concord of two sounds which are to each other as one and two, than of two sounds which are as one and three, or one and four, or one and five, or one and six or seven. Upon this pleasure, which

the mind takes in comparison, all harmony depends. The variety of sounds is infinite: but because the ear cannot compare two sounds so as readily to distinguish their discriminations when they exceed the proportion of one and seven, musicians have been content to confine all harmony within that compass, and allowed but seven notes in musical composition.

Let us now then suppose a stringed instrument fitted up in the order mentioned above. For instance: Let the first string be twice as long as the second; let the third string be three times shorter than the first; let the fourth be four times, the fifth string five times, and the sixth six times as short as the first. Such an instrument would probably give us a representation of the lyre as it came first from the hand of the inventor. This instrument will give us all the seven notes following each other, in the order in which any two of them will accord together most pleasingly; but yet it will be a very inconvenient and a very disagreeable instrument: inconvenient, for in a compass of seven strings only, the first must be seven times as long as the last; and disagreeable, because this first string will be seven times as loud also: so that when the tones are to be played in a different order, loud and soft sounds would be intermixed with most disgusting alternations. In order to improve the first instrument, therefore, succeeding musicians very judiciously threw in all the other strings between the two first, or, in other words, between the two octaves, giving to each, however, the same proportion to what it would have had in the first natural instrument. This made the instrument more portable, and the sounds more even and pleasing. They therefore disposed the sounds between the octave in their natural order, and gave each its own proportional dimensions. Of these sounds, where the proportion between any two of them is most obvious, the concord between them will be most pleasing. Thus octaves, which are as two to one, have a most harmonious effect; the fourth and fifth also sound sweetly together, and they will be found, upon calculation, to bear the same proportion to each other that octaves do. Let it not be supposed (says M. Sauveur), that the musical scale is merely an arbitrary combination of sounds; it is made up from the consonance and differences of the parts which compose it. Those who have often heard a fourth and fifth accord together, will be naturally led to discover their difference at once; and the mind unites itself to their beauties." Let us then cease to assign the coincidences of vibrations as the cause of harmony, since these coincidences in two strings vibrating at different intervals, must at best be but fortuitous; whereas concord is always pleasing. The true cause why concord is pleasing, must arise from our power, in such a case, of measuring most easily the differences of the tones. In proportion as the note can be measured with its fundamental tone by large and obvious distinctions, then the concord is most pleasing; on the contrary, when the ear measures the discriminations of two tones by very small parts, or cannot measure them at all, it loses the beauty of their resemblance: the whole is discord and pain (c).

But

(c) It is certain, that in proportion to the simplicity of relations in sound, the ear is pleased with its combinations; but this is not to be admitted as the cause why musicians have confined all harmony to an octave.

Discriminated

Musical
sounds.

But there is another property in the vibration of a musical string not yet taken notice of, and which is acknowledged to confirm the foregoing theory. If we strike the string of a harpsichord, or any other elastic sounding chord whatever, it returns a continuing sound. This till of late was considered as one simple uniform tone; but all musicians now confess, that instead of one tone it actually returns four tones, and that constantly. The notes are, beside the fundamental tone, an octave above, a twelfth above, and a seventeenth. One of the bass notes of a harpsichord has been dissected in this manner by Rameau, and the actual existence of these tones proved beyond a possibility of being controverted. In fact, the experiment is easily tried; for if we smartly strike one of the lower keys of a harpsichord, and then take the finger briskly away, a tolerable ear will be able to distinguish, that, after the fundamental tone has ceased, three other shriller tones will be distinctly heard; first the octave above, then the twelfth, and lastly the seventeenth: the octave above is in general almost mixed with the fundamental tone, so as not to be easily perceived, except by an ear long habituated to the minute discriminations of sounds. So that we may observe, that the smallest tone is heard last, and the deepest and largest one first: the two others in order.

In the whole theory of sounds, nothing has given greater room for speculation, conjecture, and disappointment, than this amazing property in elastic strings. The whole string is universally acknowledged to be in vibration in all its parts, yet this single vibration returns no less than four different sounds. They who account for the tones of strings by the number of their vibrations, are here at the greatest loss. Daniel Bernoulli supposes that a vibrating string divides itself into a number of curves, each of which has a peculiar vibration; and though they all swing together in the common vibration, yet each vibrates within itself. This opinion, which was supported, as most geometrical speculations are, with the parade of demonstration, was only born soon after to die. Others have ascribed this to an elastic difference in the parts of the air, each of which, at different intervals, thus received different impressions from the string, in proportion to their elasticity. This is absurd. If we allow the difference of tone to proceed from the force, and not the frequency, of the vibrations, this difficulty will admit of an easy solution. These sounds, though they seem to exist together in the string, actually follow each other in succession: while the vibration has greatest force, the fundamental tone is brought forward: the force of the vibration decaying, the octave is produced, but almost only instantaneously; to this succeeds, with diminished force, the twelfth; and, lastly, the seventeenth is heard to vibrate with great distinctness, while the three other tones are always silent. These sounds, thus excited, are all of them the harmonic tones, whose differences from the fundamental tone are, as was said, strong and

distinct. On the other hand, the discordant tones cannot be heard. Their differences being but very small, they are overpowered, and in a manner drowned in the tones of superior difference; yet not always neither; for Daniel Bernoulli has been able, from the same stroke, to make the same string bring out its harmonic and its discordant tones also (D). So that from hence we may justly infer, that every note whatsoever is only a succession of tones; and that those are most distinctly heard, whose differences are most easily perceivable.

To this theory, however, though it has a plausible appearance, there are strong and indeed insuperable objections. The very fundamental principle of it is false. No body whatever, whether elastic or nonelastic, yields a graver sound by being struck with a larger instrument, unless either the sounding body, or that part of it which emits the sound, is largest. In this case, the largest bodies always return the gravest sounds.

In speaking of elastic and nonelastic bodies in a musical sense, we are not to push the distinction so far as when we speak of them philosophically. A body is *musically* elastic, all of whose parts are thrown into vibrations so as to emit a sound when only part of their surface is struck. Of this kind are bells, musical strings, and all bodies whatever that are considerably hollow. Musical nonelastics are such bodies as emit a sound only from that particular place which is struck: thus, a table, a plate of iron nailed on wood, a bell sunk in the earth, are all of them nonelastics in a musical sense, though not philosophically so. When a solid body, such as a log of wood, is struck with a switch, only that part of it emits a sound which comes in contact with the switch; the note is acute and loud, but would be no less so though the adjacent parts of the log were removed. If, instead of the switch, a heavier or larger instrument is made use of, a larger portion of its surface then returns a sound, and the note is consequently more grave; but it would not be so if the large instrument was struck with a sharp edge, or a surface only equal to that of the small one.

In sounds of this kind, where there is only a single thwack, without any repetition, the immediate cause of the gravity or acuteness seems to be the quantity of air displaced by the sounding body; a large quantity of air displaced produces a grave sound, and a smaller quantity a more acute one, the force wherewith the air is displaced signifying very little. What we here advance is confirmed by some experiments made by Dr Priestley, concerning the *musical* tone of electrical discharges. The passage being curious, and not very long, we shall here transcribe it.

"As the course of my experiments has required a great variety of electrical explosions, I could not help observing a great variety in the musical tone made by the reports. This excited my curiosity to attempt to reduce this variation to some measure. Accordingly,

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Discriminated sounds, whose vibrations either never coincide, or at least very rarely, do not only cease to please, but violently grate the ear. Harmony and discord, therefore, are neither discriminated by the judgment of hearers, nor the institution of musicians, but by their own essential and immutable nature.

(D) Vid. Memoires de l'Academie de Berlin, 1753, p. 153.

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by the help of a couple of spinets, and two persons who had good ears for music, I endeavoured to ascertain the tone of some electrical discharges; and observed that every discharge made several strings, particularly those that were chords to one another, to vibrate; but one note was always predominant, and sounded after the rest. As every explosion was repeated several times, and three of us separately took the same note, there remained no doubt but that the tone we fixed upon was at least very near the true one. The result was as follows:

"A jar containing half a square foot of coated glass sounded F sharp, concert pitch. Another jar of a different form, but equal surface, sounded the same.

"A jar of three square feet sounded C below F sharp. A battery consisting of sixty-four jars, each containing half a square foot, sounded F below the C.

"The same battery, in conjunction with another of thirty-one jars, sounded C sharp. So that a greater quantity of coated glass always gave a deeper note.

"Differences in the degree of a charge in the same jar made little or no difference in the tone of the explosion; if any, a higher charge gave rather a deeper note."

These experiments shew us how much the gravity or acuteness of sounds depends on the quantity of air put in agitation by the sounding body. We know that the noise of the electric explosion, arises from the return of the air into the vacuum produced by the electric flash. The larger the vacuum, the deeper was the note: for the same reason, the discharge of a musket produces a more acute note than that of a cannon; and thunder is deeper than either.

Besides this, however, other circumstances concur to produce different degrees of gravity or acuteness in sounds. The sound of a table struck upon with a piece of wood, will not be the same with that produced from a plate of iron struck by the same piece of wood, even if the blows should be exactly equal, and the iron perfectly kept from vibrating. Here the sounds are generally said to differ in their degrees of acuteness, according to the specific gravities or densities of the substances which emit them. Thus gold, which is the most dense of all metals, returns a much graver sound than silver; and metalline wires, which are more dense than thermes, return a proportionably graver sound. But neither does this appear to be a general rule in which we can put confidence. Bell-metal is denser than copper, but it by no means appears to yield a graver sound: on the contrary, it seems very probable, that copper will give a graver sound than bell-metal, if both are struck upon in their non-elastic state; and we can by no means think that a bell of pure tin, the least dense of all the metals, will give a more acute sound than one of bell-metal, which is greatly more dense. In some bodies hardness seems to have a considerable effect. Glass, which is considerably harder than any metal, gives a more acute sound; bell-metal is harder than gold, lead, or tin, and therefore sounds much more acutely: though how far this holds with regard to other substances, there is not a sufficient number of experiments for us to judge.

In bodies musically elastic, the whole substance vibrates with the slightest stroke, and therefore they always give the same note whether they are struck with

a large or with a small instrument; so that; striking a part of the surface of any body musically elastic is equivalent in it, to striking the whole surface of a non-elastic one. If the whole surface of a table was struck with another table, the note produced would be neither more nor less acute whatever force was employed; because the whole surface would then yield a sound, and no force could increase the surface: the sound would indeed be louder in proportion to the force employed, but the gravity would remain the same. In like manner, when a bell or musical string is struck, the whole substance vibrates, and a greater stroke cannot increase the substance. Hence we see the fallacy of what is said concerning the Pythagorean anvils. An anvil is a body musically elastic, and no difference in the tone can be perceived whether it is struck with a large or with a small hammer; because either of them are sufficient to make the whole substance vibrate, provided nothing but the anvil is struck upon: smiths, however, do not strike their anvils, but red hot-iron laid upon their anvils; and thus the vibrations of the anvil are stopped, so that it becomes a non-elastic body, and the differences of tone in the strokes of different hammers proceed only from the surface of the large hammers covering the whole surface of the iron, or at least a greater part of it than the small ones. If the small hammer is sufficient to cover the whole surface of the iron as well as the large one, the note produced will be the same whether the large or the small hammer is used.

Lastly, The argument for the preceding theory, grounded on the production of what are called *flute-notes* on the violin, is built on a false foundation; for the bow being lightly drawn on an open string, produces no *flute-notes*, but only the harmonies of the note to which the string is tuned. The *flute-notes* are produced by a particular motion of the bow, quick and near the bridge, and by fingering very gently. By this management the same sounds are produced, though at certain intervals only, as if the vibrations were transferred to the space between the end of the finger-board and the finger, instead of that between the finger and the bridge. Why this small part of the string should vibrate in such a case, and not that which is under the immediate action of the bow, we must own ourselves ignorant; nor dare we affirm that the vibrations really are transferred in this manner, only the same sounds are produced as if they were.

Though these objections seem sufficiently to overturn the foregoing theory, with regard to acute sounds being the effects of weak strokes, and grave ones of stronger impulses, we cannot admit that longer or shorter vibrations are the occasions of gravity or acuteness in sound. A musical sound, however lengthened, either by a string or bell, is only a repetition of a single one, whose duration by itself is but for a moment, and is therefore termed *inapprehtable*, like the smack of a whip, or the explosion of an electrical battery. The continuation of the sound is nothing more than a repetition of this instantaneous inapprehtable noise after the manner of an echo, and it is only this echo that makes the sound agreeable. For this reason, music is much more agreeable when played in a large hall where the sound is reverberated, than in a small room where there is no such reverberation. For the same reason, the sound of a string is more agreeable when put on a hol-

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low violin than when fastened to a plain board, &c.—In the sound of a bell we cannot avoid observing this echo very distinctly. The sound appears to be made up of distinct pulses, or repetitions of the same note produced by the stroke of the hammer. It can by no means be allowed, that the note would be more acute though these pulses were to succeed one another more rapidly; the sound would indeed become more simple, but would still preserve the same tone.—In musical strings the reverberations are vastly more quick than in bells; and therefore their sound is more uniform or simple, and consequently more agreeable than that of bells. In musical glasses *, the vibrations must be inconceivably quicker than in any bell or stringed instrument: and hence they are of all others the most simple and the most agreeable, though neither the most acute nor the loudest.—As far as we can judge, quickness of vibration contributes to the uniformity, or simplicity, but not to the acuteness, nor to the loudness, of a musical note.

* See Har-
monica.

It may here be objected, that each of the different pulses, of which we observe the sound of a bell to be composed, is of a very perceptible length, and far from being instantaneous; so that it is not fair to infer that the sound of a bell is only a repetition of a single instantaneous stroke, seeing it is evidently the repetition of a lengthened note.—To this it may be replied, that the inappreciable sound which is produced by striking a bell in a non-elastic state, is the very same which, being first propagated round the bell, forms one of these short pulses that is afterwards re-echoed as long as the vibrations of the metal continue, and it is impossible that the quickness of repetition of any sound can either increase or diminish its gravity.

CHAP. II. *Of the Propagation of Sound. Newton's Doctrine explained and vindicated.*

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THE writers on sound have been betrayed into these difficulties and obscurities, by rejecting the 47th proposition, B. II. of Newton, as inconclusive reasoning. Of this proposition, however, the late ingenious Dr Matthew Young bishop of Clonfert, formerly of Trinity college, Dublin, has given a clear, explanatory, and able defence. He candidly owns that the demonstration is obscurely stated, and takes the liberty of varying, in some degree, from the method pursued by Newton.

"1. The parts of all sounding bodies (he observes), vibrate according to the law of a cycloidal pendulum: for they may be considered as composed of an indefinite number of elastic fibres; but these fibres vibrate according to that law. *Vide Helsham, p. 270.*

"2. Sounding bodies propagate their motions on all sides *in directum*, by successive condensations and rarefactions, and successive goings forward and returnings backward of the particles. *Vide Prop. 43. B. II. Newton Princip.*

"3. The pulses are those parts of the air which vibrate backwards and forwards; and which, by going forward, strike (*pulsant*) against obstacles. The latitude of a pulse is the rectilineal space through which the motion of the air is propagated during one vibration of the sounding body.

"4. All pulses move equally fast. This is proved
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by experiment; and it is found that they describe 1070 Paris feet, or 1142 London feet in a second, whether the sound be loud or low, grave or acute.

"5. Prob. To determine the latitude of a pulse. Divide the space which the pulse describes in a given time (4) by the number of vibrations performed in the same time by the sounding body, (*Cor. 1. Prop. 24. Smith's Harmonics*), the quotient is the latitude.

"M. Sauveur, by some experiments on organ pipes, found that a body, which gives the gravest harmonic sound, vibrates 12 times and a half in a second, and that the shrillest sounding body vibrates 51.100 times in a second. At a medium, let us take the body which gives what Sauveur calls his *fixed sound*: it performs 100 vibrations in a second, and in the same time the pulses describe 1070 Parisian feet; therefore the space described by the pulses whilst the body vibrates once, that is, the latitude, or interval of the pulse, will be 10.7 feet.

"6. Prob. To find the proportion which the greatest space, through which the particles of the air vibrate, bears to the radius of a circle, whose perimeter is equal to the latitude of the pulse.

"During the first half of the progress of the elastic fibre, or sounding body, it is continually getting nearer to the next particle; and during the latter half of its progress, that particle is getting farther from the fibre, and these portions of time are equal (*Helsham*): therefore we may conclude, that at the end of the progress of the fibre, the first particle of air will be nearly as far distant from the fibre as when it began to move, and in the same manner we may infer, that all the particles vibrate through spaces nearly equal to that run over by the fibre.

"Now M. Sauveur (*Acad. Scienc. ann. 1700, p. 141.*) has found by experiment, that the middle point of a chord which produces his *fixed sound*, and whose diameter is $\frac{1}{2}$ of a line, runs over in its smallest sensible vibrations $\frac{1}{8}$ of a line, and in its greatest vibration 72 times that space; that is, $72 \times \frac{1}{8}$ of a line, or 4 lines, that is, $\frac{1}{3}$ of an inch.

"The latitude of the pulses of this fixed sound is 10.7 feet (5); and since the circumference of a circle is to its radius as 710 is to 113, the greatest space described by the particles will be to the radius of a circle, whose periphery is equal to the latitude of the pulse as $\frac{1}{3}$ of an inch is to 1.7029 feet, or 20.4348 inches, that is, as 1 to 61.3044.

"If the length of the string be increased or diminished in any proportion, *ceteris paribus*, the greatest space described by its middle point will vary in the same proportion. For the inflecting force is to the tending force as the distance of the string from the middle point of vibration to half the length of the string (see *Helsham* and *Martin*); and therefore the inflecting and tending forces being given, the string will vibrate through spaces proportioned to its length; but the latitude of the pulse is inversely as the number of vibrations performed by the string in a given time (5), that is, directly as the time of one vibration, or directly as the length of the string (*Prop. 24. Cor. 7. Smith's Harmonics*); therefore the greatest space through which the middle point of the string vibrates will vary in the direct ratio of the latitude of the pulse, or of the radius of a circle whose circumference is equal

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to the latitude, that is, it will be to that radius as 1 to 61.3044.

"7. If the particles of the aerial pulses, during any part of their vibration, be successively agitated, according to the law of a cycloidal pendulum, the comparative elastic forces, arising from their mutual action, by which they will afterwards be agitated, will be such as will cause the particles to continue that motion, according to the same law, to the end of their vibration.

"Let AB, BC, CD, &c. fig. 3. denote the equal distances of the successive pulses; ABC the direction of the motion of the pulses propagated from A towards B; E, F, G, three physical points of the quiescent medium, situated in the right line AC at equal distances from each other; Ee, Ff, Gg, the very small equal spaces through which these particles vibrate; ϵ, ϕ, γ , any intermediate places of these points. Draw the right line PS, fig. 4. equal to Ee, bisect it in O, and from the centre O with the radius OP describe the circle SIPh. Let the whole time of the vibration of a particle and its parts be denoted by the circumference of this circle and its proportional parts. And since the particles are supposed to be at first agitated according to the law of a cycloidal pendulum, if at any time PH or PHSk, the perpendicular HL or hl, be let fall on PS, and if Ee be taken equal to PL or Pl, the particle E shall be found in ϵ . Thus will the particle E perform its vibrations according to the law of a cycloidal pendulum. Prop. 52. B. I. *Principia*.

"Let us suppose now, that the particles have been successively agitated, according to this law, for a certain time, by any cause whatsoever, and let us examine what will be the comparative elastic forces arising from their mutual action, by which they will afterwards continue to be agitated.

"In the circumference PHSk take the equal arches HI, IK in the same ratio to the whole circumference which the equal right lines EF, FG, have to BC the whole interval of the pulses; and let fall the perpendiculars HL, IM, KN. Since the points E, F, G are successively agitated in the same manner, and perform their entire vibrations of progress and regress while the pulse is propagated from B to C, if PH be the time from the beginning of the motion of E, PI will be the time from the beginning of the motion of F, and PK the time from the beginning of the motion of G; and therefore Ee, Ff, Gg will be respectively equal to PL, PM, PN in the progress of the particles. Whence $\epsilon\phi$ or EF + Ff - Ee is equal to EF - LM. But $\epsilon\phi$ is the expansion of EF in the place $\epsilon\phi$, and therefore this expansion is to its mean expansion as EF - LM to EF. But LM is to IH as IM is to OP; and IH is to EF as the circumference PHSk is to BC; that is, as OP is to V, if V be the radius of a circle whose circumference is BC; therefore, *ex aquo*, LM is to EF as IM is to V; and therefore the expansion of EF in the place $\epsilon\phi$ is to its mean expansion as V - IM is to V; and the elastic force existing between the physical points E and F is to the mean elastic force as

$$\frac{1}{V-IM} \text{ is to } \frac{1}{V} \text{ (Cotes Pneum. Lect. 9.) By the same}$$

argument, the elastic force existing between the physical points F and G is to the mean elastic force as

$\frac{1}{V-KN}$ is to $\frac{1}{V}$; and the difference between these forces is to the mean elastic force as

$$\frac{IM-KN}{V^2-V \cdot IM-V \cdot KN+IM \cdot KN} \text{ is to } \frac{1}{V}; \text{ that is, as } \frac{IM-KN}{V^2} \text{ is to } \frac{1}{V}; \text{ or as } IM-KN \text{ is to } V; \text{ if on-}$$

ly (upon account of the very narrow limits of the vibration) we suppose IM and KN to be indefinitely less than V. Wherefore since V is given, the difference of the forces is as IM - KN, or as HL - IM (because KH is bisected in I); that is, (because HL - IM is to IH as OM is to OI or OP, and IH and OP are given quantities) as OM; that is, if Ef be bisected in Ω as $\Omega\phi$.

"In the same manner it may be shown, that if PHSk be the time from the beginning of the motion of E, PHSi will be the time from the beginning of the motion of F, and PHSk the time from the beginning of the motion of G; and that the expansion of EF in the place $\epsilon\phi$ is to its mean expansion as EF + Ff - Ee, or as EF + lm is to EF, or as V + hl is to V in its regress: and its elastic force to the mean elastic force as $\frac{1}{V+hl}$ is to $\frac{1}{V}$; and that the difference of the elastic forces existing between E and F, and between F and G is to the mean elastic force as $kn-im$ is to V; that is, directly as $\Omega\phi$.

"But this difference of the elastic forces, existing between E and F, and between F and G, is the comparative elastic force by which the physical point ϕ is agitated: and therefore the comparative accelerating force, by which every physical point in the medium will continue to be agitated both in progress and regress, will be directly as its distance from the middle point of its vibration; and consequently will be such as will cause the particles to continue their motion undisturbed, according to the law of a cycloidal pendulum. Prop. 38. l. i. *Newton. Principia*.

"Newton rejects the quantity $=V \times \frac{IM+KN}{V^2} + \frac{IM \times KN}{V^2}$, on supposition that IM and KN are indefinitely less than V. Now, although this may be a reasonable hypothesis, yet, that this quantity may be safely rejected, will, I think, appear in a more satisfactory manner from the following considerations derived from experiment: PS, in its greatest possible state, is to V as 1 is to 61.3044 (6); and therefore IM, or KN, in its greatest possible state, (that is, when the vibrations of the body are as great as possible, and the particle in the middle point of its vibration) is to V as 1 is to 122.6. Hence $V^2 = 15030.76$, $-V \times \frac{IM+KN}{V^2} = 245.2$ and $\frac{IM \times KN}{V^2} = 1$; therefore V^2 is to $V^2 - V \times \frac{IM+KN}{V^2} + \frac{IM \times KN}{V^2}$ as 15.03076 is to 14786.56; that is, as 61 is to 60 nearly.

"Hence it appears, that the greatest possible error in the accelerating force, in the middle point, is the $\frac{1}{60}$ st part of the whole. In other points it is much less; and in the extreme points the error entirely vanishes.

"We should also observe, that the ordinary sounds we hear are not produced by the greatest possible vibrations of which the sounding body is capable; and that in general IM and KN are nearly evanescent with respect

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respect to V. And very probably the disagreeable sensations we feel in very loud sounds, arise not only from IM or KN bearing a sensible proportion to V, by which means the cycloidal law of the pulses may be in some measure disturbed, but also from the very law of the motion of the sounding body itself being disturbed. For the proof of this law's being observed by an elastic fibre is founded on the hypothesis that the space, through which it vibrates, is indefinitely little with respect to the length of the string. See *Smith's Harmonics*, p. 237. *Helsham*, p. 270.

" 8. If a particle of the medium be agitated according to the law of a cycloidal pendulum, the comparative elastic force, acting on the adjacent particle, from the instant in which it begins to move, will be such as will cause it to continue its motion according to the same law.

For let us suppose, that three particles of the medium had continued to move for times denoted by the arches PK, PI, PH, the comparative elastic force, acting on the second during the time of its motion, would have been denoted by HL—IM, that is, would have been directly as MO (7). And if this time be diminished till I becomes coincident with P, that is, if you take the particles in that state when the second is just beginning to move, and before the third particle has yet been set in motion; then the point M will fall on P, and MO become PO; that is, the comparative elastic force of the second particle, at the instant in which it begins to move, will be to the force with which it is agitated in any other moment of time, before the subsequent particle has yet been set in motion, directly as its distance from the middle point of vibration. Now this comparative elastic force, with which the second particle is agitated in the very moment in which it begins to move, arises from the preceding particle's approaching it according to the law of a pendulum; and therefore, if the preceding particle approaches it in this manner, the force by which it will be agitated, in the very moment it begins to move, will be exactly such as should take place in order to move it according to the law of a pendulum. It therefore sets out according to that law, and consequently the subsequent elastic forces generated in every successive moment, will also continue to be of the just magnitude which should take place, in order to produce such a motion.

" 9. The pulses of the air are propagated from sounding bodies, according to the law of a cycloidal pendulum. The point E, fig. 3. of any elastic fibre producing a sound, may be considered as a particle of air vibrating according to the law of a pendulum (1). This point E will therefore move according to this law for a certain time, denoted by the arch IH, fig. 4. before the second particle begins to move; for sound is propagated in time through the successive particles of air (4). Now from that instant, the comparative elastic force which agitates F, is (8) directly as its distance from the middle point of vibration. F therefore sets out with a motion according to the law of a pendulum: and therefore the comparative elastic force by which it will be agitated until G begins to move, will continue that law (8). Consequently F will approach G in the same manner as E approached F, and the comparative elastic force of G, from the in-

stant in which it begins to move, will be directly as its distance from the middle point of vibration; and so on in succession. Therefore all the particles of air in the pulses successively set out from their proper places according to the law of a pendulum, and therefore (7) will finish their entire vibrations according to the same law.

" Cor. 1. The number of pulses propagated is the same with the number of vibrations of the tremulous body, nor is it multiplied in their progress; because the little physical line α , fig. 3. as soon as it returns to its proper place, will there quiesce: for its velocity, which is denoted by the sine IM, then vanishes, and its density becomes the same with that of the ambient medium. This line, therefore, will no longer move, unless it be again driven forwards by the impulse of the sounding body, or of the pulses propagated from it.

" Cor. 2. In the extreme points of the little space through which the particle vibrates, the expansion of the air is in its natural state; for the expansion of the physical line is to its natural expansion as $V \mp IM$ is to V; but IM is then equal to nothing. In the middle point of the progress the condensation is greatest: for IM is then greatest, and consequently the expansion $V - IM$ least. In the middle of the regress, the rarefaction is greatest, for im , and consequently $V + im$, is then greatest.

" 10. To find the velocity of the pulses, the density and elastic force of the medium being given.

" This is the 49th Prop. B. II. Newton, in which he shows, that whilst a pendulum, whose length is equal to the height of the homogeneous atmosphere, vibrates once forwards and backwards, the pulses will describe a space equal to the periphery of a circle described with that altitude as its radius.

" Cor. 1. He thence shows, that the velocity of the pulses is equal to that which a heavy body would acquire in falling down half the altitude of that homogeneous atmosphere; and therefore, that all pulses move equally fast, whatever be the magnitude of PS, or the time of its being described; that is, whether the tone be loud or low, grave or acute. See *Hales de Sonis*, § 49.

" Cor. 2. And also, that the velocity of the pulses is in a ratio compounded of the direct subduplicate ratio of the elastic force of the medium, and the inverse subduplicate of its density. Hence sounds move somewhat faster in summer than in winter. See *Hales de Sonis*, p. 141.

" 11. The strength of a tone is as the moment of the particles of air. The moment of these particles (the medium being given) is as their velocity; and the velocity of these particles is as the velocity of the string which sets them in motion (9). The velocities of two different strings are equal when the spaces which they describe in their vibrations are to each other as the times of these vibrations: therefore, two different tones are of equal strength, when the spaces, through which the strings producing them vibrate, are directly as the times of their vibration.

" 12. Let the strength of the tones of the two strings AB, CD, which differ in tension only (fig. 5. 6.) be equal. Quere the ratio of the inflecting forces F and f^2 . From the hypothesis of the equality of the strength of the tones, it follows (11), that the space

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Sound.

GE must be to the space HF as $f\frac{1}{2}$ to $F\frac{1}{2}$ (*Smith's Harm. Prop. 24. Cor. 4.*). Now the forces inflecting AB, CD, through the equal spaces GE, HP, are to each other as the tending forces, that is, as F to f. (*Malcom's Treatise on Music, p. 52.*). But the force inflecting CD through HP is to the force inflecting it through HF as HP or GE to HF (*ib. p. 47.*), that is, by the hyp. as $f\frac{1}{2}$ to $F\frac{1}{2}$. Therefore, *ex æquo*, the forces inflecting AB and CD, when the tones are equally strong, are to each other as $F \times f\frac{1}{2}$ to $f \times F\frac{1}{2}$, or as $F\frac{1}{2}$ to $f\frac{1}{2}$. That is, the forces necessary to produce tones of equal strength in various strings which differ only in tension, are to each other in the subduplicate ratio of the tending forces, that is, inversely as the time of one vibration, or directly as the number of vibrations performed in a given time. Thus, if CD be the acute octave to AB, its tending force will be quadruple that of AB, (*Malcom's Treatise on Music, p. 53.*): and therefore to produce tones of equal strength in these strings, the force impelling CD must be double that impelling AB; and so in other cases.

"Suppose, now, that the strings AB, CD (fig. 6. 7.) differ in length only. The force inflecting AB through GE is to the tending force, which is given, as GE to AG; and this tending force is to the force inflecting CD through the space HP equal to GE, as HD to HP. Therefore, *ex æquo*, the forces inflecting AB and CD through the equal spaces GE and HP, are to each other as HD to AG, or as CD to AB. But the force inflecting CD through HP is to the force inflecting it through HF, as HP or GE to HF, that is, because these spaces are as the times (11), as AB to CD. Therefore, *ex æquo*, the forces inflecting AB and CD, when the tones are equally strong, are to each other in a ratio of equality. Hence we should suppose, that in this case, an equal number of equal impulses would generate equally powerful tones in these strings. But we are to observe, that the longer the string, the greater, *ceteris paribus*, is the space through which a given force inflects it (*Malcom*); and therefore whatever diminution is produced in the spaces through which the strings move in their successive vibrations, arising either from the want of perfect elasticity in the strings, or from the resistance of the air, this diminution will bear a greater proportion to the less space through which the shorter string vibrates. And this is confirmed by experience; for we find that the duration of the tone and motion of the whole string exceeds that of any of its subordinate parts. Therefore, after a given interval of time, a greater quantity of motion will remain in the longer string: and consequently, after the successive equal impulses have been made, a greater degree of motion will still subsist in it. That is, a given number of equal impulses being made on various strings differing in length only, a stronger sound will be produced in that which is the longer."

CHAP. III. Of the Velocity, &c. of Sound. Axioms.

Velocity of
sound.

BY the experiments of some philosophers it has been proved, that sound travels at about the rate of 1142 feet in a second, or near 13 miles in a minute; nor do any obstacles hinder its progress, a contrary wind only a small matter diminishing its velocity. The method of calculating its progress is easily made known. When

a gun is discharged at a distance, we see the fire long before we hear the sound. If then we know the distance of the place, and know the time of the interval between our first seeing the fire and then hearing the report, this will shew us exactly the time the sound has been travelling to us. For instance, if the gun is discharged a mile off, the moment the flash is seen, you take a watch and count the seconds till you hear the sound; the number of seconds is the time the sound has been travelling a mile. Again, By the above axiom, we are enabled to find the distance between objects that would be otherwise immeasurable. For example, suppose you see the flash of a gun in the night at sea, and tell seven seconds before you hear the report, it follows therefore that the distance is seven times 1142 feet, that is, 24 yards more than a mile and a half. In like manner, if you observe the number of seconds between the lightning and the report of the thunder, you know the distance of the cloud from whence it proceeds.

Reverberated
Sounds.
Its progress
calculated.

Distances
calculated
by means of
sound.

But according to another philosopher, Dr Thomas Young, the velocity of sound is not quite so great. "It has been demonstrated, he observes, by M. de la Grange and others, that any impression whatever communicated to one particle of an elastic fluid, will be transmitted through that fluid with an uniform velocity, depending on the constitution of the fluid, without reference to any supposed laws of the continuation of that impression. Their theorem for ascertaining this velocity is the same as Newton has deduced from the hypothesis of a particular law of continuation: but it must be confessed, that the result differs somewhat too widely from experiment, to give us full confidence in the perfection of the theory. Corrected by the experiments of various observers, the velocity of any impression transmitted by the common air, may, at an average, be reckoned 1130 feet in a second." (*Phil. Trans. vol. xc. p. 116.*)

Derham has proved by experiment, that all sounds travel at the same rate. The sound of a gun and the striking of a hammer, are equally swift in their motions; the softest whisper flies as swiftly, as far as it goes, as the loudest thunder.

To these axioms we may add the following:

Smooth and clear sounds proceed from bodies that are homogeneous, and of an uniform figure; and harsh or obtuse sounds, from such as are of a mixed matter and irregular figure.

The velocity of sounds is to that of a brisk wind as fifty to one.

The strength of sounds is greatest in cold and dense air, and least in that which is warm and rarefied.

Every point against which the pulses of sound strike, becomes a centre from which a new series of pulses are propagated in every direction.

Sound describes equal spaces in equal times.

CHAP. IV. Of Reverberated Sounds.

SOUND, like light, after it has been reflected from several places may be collected in one point, as into a focus; and it will be there more audible than in any other part, even than at the place from whence it proceeded. On this principle it is that a whispering gallery is constructed.

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The form of a whispering gallery must be that of a concave hemisphere (E) as ABC, fig. 8.; and if a low sound or whisper be uttered at A, the vibrations expanding themselves every way will impinge on the points DDD, &c. and from thence be reflected to EEE, and from thence to the points F and G, till at last they all meet in C, where, as we have said, the sound will be the most distinctly heard.

speaking-
trumpet.

The augmentation of sound by means of speaking-trumpets, is usually illustrated in the following manner: Let ABC, fig. 9. be the tube, BD the axis, and B the mouth-piece for conveying the voice to the tube. Then it is evident when a person speaks at B in the trumpet, the whole force of his voice is spent upon the air contained in the tube, which will be agitated through its whole length, and, by various reflections from the side of the tube to the axis, the air along the middle part of the tube will be greatly condensed, and its *momentum* proportionably increased, so that when it comes to agitate the air at the orifice of the tube AC, its force will be as much greater than what it would have been without the tube, as the surface of a sphere, whose radius is equal to the length of the tube, is greater than the surface of the segment of such a sphere whose base is the orifice of the tube. For a person speaking at B, without the tube, will have the force of his voice spent in exciting concentric superficies of air all round the point B; and when those superficies or pulses of air are diffused as far as D every way, it is plain the force of the voice will there be diffused through the whole superficies of a sphere whose radius is BD; but in the trumpet it will be so confined, that at its exit it will be diffused through so much of that spherical surface of air as corresponds to the orifice of the tube. But since the force is given, its intensity will be always inversely as the number of particles it has to move; and therefore in the tube it will be to that without, as the superficies of such a sphere to the area of the large end of the tube nearly.

"But it is obvious, Dr M. Young observes, that the confinement of the voice can have little effect in increasing the strength of the sound, as this strength depends on the velocity with which the particles move. Were this reasoning conclusive, the voice should issue through the smallest possible orifice; cylindrical tubes would be preferable to any that increased in diameter; and the less the diameter, the greater would be the effect of the instrument; because, the plate or mass of air to be moved, would, in that case, be less, and consequently the effect of the voice the greater; all which is contradicted by experience.

"The cause of the increase of sound in these tubes must therefore be derived from some other principles: and among these we shall probably find, that what the ingenious Kircher has suggested in his *Phonurgia* is the most deserving of our attention. He tells us, that "the augmentation of the sound depends on its reflection from the tremulous sides of the tube; which reflections, conspiring in propagating the pulses in the same direction, must increase its intensity." Newton also seems

to have considered this as the principal cause, in the scholium of Prop. 50. B. II. Princip. when he says, "we hence see why sounds are so much increased in stentorophonic tubes, for every reciprocal motion is, in each return, increased by the generating cause.

"Farther, When we speak in the open air, the effect on the tympanum of a distant auditor is produced merely by a single pulse. But when we use a tube, all the pulses propagated from the mouth, except those in the direction of the axis, strike against the sides of the tube, and every point of impulse becoming a new centre, from whence the pulses are propagated in all directions, a pulse will arrive at the ear from each of those points; thus, by the use of a tube, a greater number of pulses are propagated to the ear, and consequently the sound increased. The confinement too of the voice may have a little effect, though not such as is ascribed to it by some; for the condensed pulses produced by the naked voice, freely expand every way; but in tubes, the lateral expansion being diminished, the direct expansion will be increased, and consequently the velocity of the particles, and the intensity of the sound. The substance also of the tube has its effect; for it is found by experiment, that the more elastic the substance of the tube, and consequently the more susceptible it is of these tremulous motions, the stronger is the sound.

"If the tube be laid on any nonelastic substance, it deadens the sound, because it prevents the vibratory motion of the parts. The sound is increased in speaking-trumpets, if the tube be suspended in the air; because the agitations are then carried on without interruption. These tubes should increase in diameter from the mouth-piece, because the parts vibrating in directions perpendicular to the surface will conspire in impelling forward the particles of air, and consequently, by increasing their velocity, will increase the intensity of the sound: and the surface also increasing, the number of points of impulse and of new propagation will increase proportionally. The several causes, therefore, of the increase of sound in these tubes, Dr Young concludes to be, 1. The diminution of the lateral, and consequently the increase of the direct, expansion and velocity of the included air. 2. The increase of the number of pulses, by increasing the points of new propagation. 3. The reflections of the pulses from the tremulous sides of the tube, which impel the particles of air forward, and thus increase their velocity." (*Enquiry into the principal Phenomena of Sound*, p. 56.)

An echo is a reflection of sound striking against some object, as an image is reflected in a glass: but it has been disputed what are the proper qualities in a body for thus reflecting sounds. It is in general known, that caverns, grottoes, mountains, and ruined buildings, return this reflection of sound. We have heard of a very extraordinary echo, at a ruined fortress near Louvain, in Flanders. If a person sung, he only heard his own voice, without any repetition: on the contrary, those who stood at some distance heard the echo but not the voice; but then they heard it with surprising variations, sometimes louder, sometimes softer, now more near,

(E) A cylindric or elliptic arch will answer still better than one that is circular.

Reverberated Sounds.

near, then more distant. There is an account in the memoirs of the French Academy, of a similar echo near Rouen.

It has been already observed that every point against which the pulses of sound strike becomes the centre of a new series of pulses, and sound describes equal distances in equal times; therefore, when any sound is propagated from a centre, and its pulses strike against a variety of obstacles, if the sum of the right lines drawn from that point to each of the obstacles, and from each obstacle to a second point, be equal, then will the latter be a point in which an echo will be heard. "Thus let A fig. 10. be the point from which the sound is propagated in all directions, and let the pulses strike against the obstacles C, D, E, F, G, H, I, &c. each of these points becomes a new centre of pulses by the first principle, and therefore from each of them one series of pulses will pass through the point B. Now if the

several sums of the right lines $\overline{AC+CB}$, $\overline{AD+DB}$, $\overline{AE+EB}$, $\overline{AG+GB}$, $\overline{AH+HB}$, $\overline{AI+IB}$, &c. be all equal to each other, it is obvious that the pulses propagated from A to these points, and again from these points to B, will all arrive at B at the same instant, according to the second principle; and therefore, if the hearer be in that point, his ear will at the same instant be struck by all these pulses. Now it appears from experiment (see *Musschenbroek*, vol. ii. p. 210.), that the ear of an exercised musician can only distinguish such sounds as follow one another at the rate of 9 or 10 in a second, or any slower rate: and therefore, for a distinct perception of the direct and reflected sound, there should intervene the interval of $\frac{1}{9}$ th of a second; but in this time sound describes $\frac{1142}{9}$ or 127 feet nearly. And therefore, unless the sum of the lines drawn from each of the obstacles to the points A and B exceeds the interval AB by 127 feet, no echo will be heard at B. Since the several sums of the lines drawn from the obstacles to the points A and B are of the same magnitude, it appears that the curve passing through all the points C, D, E, F, G, H, I, &c. will be an ellipse, (*Prop. 14. b. ii. Ham. Con.*). Hence all the points of the obstacles which produce an echo, must lie in the surface of the oblong spheroid, generated by the revolution of this ellipse round its major axis.

"As there may be several spheroids of different magnitudes, so there may be several different echoes of the same original sound. And as there may happen to be a greater number of reflecting points in the surface of an exterior spheroid than in that of an interior, a second or a third echo may be much more powerful than the first, provided that the superior number of reflecting points, that is, the superior number of reflected pulses propagated to the ear, be more than sufficient to compensate for the decay of sound which arises from its being propagated through a greater space. This is finely illustrated in the celebrated echoes at the lake of Killarney in Kerry, where the first return of the sound is much inferior in strength to those which immediately succeed it.

"From what has been laid down it appears, that for the most powerful echo, the sounding body should be in one focus of the ellipse which is the section of the

echoing spheroid, and the hearer in the other. However, an echo may be heard in other situations, though not so favourably; as such a number of reflected pulses may arrive at the same time at the ear as may be sufficient to excite a distinct perception. Thus a person often hears the echo of his own voice; but for this purpose he should stand at least 63 or 64 feet from the reflecting obstacle, according to what has been said before. At the common rate of speaking, we pronounce not above three syllables and a half, that is, seven half syllables in a second; therefore, that the echo may return just as soon as three syllables are expressed, twice the distance of the speaker from the reflecting object must be equal to 1000 feet; for as sound describes 1142 feet in a second, $\frac{1}{2}$ ths of that space, that is, 1000 feet nearly, will be described while six half or three whole syllables are pronounced; that is, the speaker must stand near 500 feet from the obstacle. And in general, the distance of the speaker from the echoing surface, for any number of syllables, must be equal to the seventh part of the product of 1142 feet multiplied by that number.

"In churches we never hear a distinct echo of the voice, but a confused sound when the speaker utters his words too rapidly; because the greatest difference of distance between the direct and reflected courses of such a number of pulses as would produce a distinct sound, is never in any church equal to 127 feet, the limit of echoes.

"But though the first reflected pulses may produce no echo, both on account of their being too few in number, and too rapid in their return to the ear; yet it is evident, that the reflecting surface may be so formed, as that the pulses which come to the ear after two reflections or more, may, after having described 127 feet or more, arrive at the ear in sufficient numbers, and also so nearly at the same instant, as to produce an echo, though the distance of the reflecting surface from the ear be less than the limit of echoes. This is confirmed by a singular echo in a grotto on the banks of the little brook called the Dinan, about two miles from Castlecomber, in the county of Kilkenny. As you enter the cave, and continue speaking loud, no return of the voice is perceived; but on your arriving at a certain point, which is not above 14 or 15 feet from the reflecting surface, a very distinct echo is heard. Now this echo cannot arise from the first course of pulses that are reflected to the ear, because the breadth of the cave is so small, that they would return too quickly to produce a distinct sensation from that of the original sound: it therefore is produced by those pulses, which, after having been reflected several times from one side of the grotto to the other, and having run over a greater space than 127 feet, arrive at the ear in considerable numbers, and not more distant from each other, in point of time, than the ninth part of a second."

To what has been said of reflected sounds, we shall add an extract on the same subject from the ingenious paper which we have already quoted.

"M. de la Grange has also demonstrated, that all impressions are reflected by an obstacle terminating an elastic fluid, with the same velocity with which they arrived at that obstacle. When the walls of a passage,

Reverberated Sounds.

Amusing
Experi-
ments, &c.

or of an unfurnished room, are smooth and perfectly parallel, any explosion, or a stamping with the foot, communicates an impression to the air, which is reflected from one wall to the other, and from the second again towards the ear, nearly in the same direction with the primitive impulse: this takes place as frequently in a second, as double the breadth of the passage is contained in 1130 feet; and the ear receives a perception of a musical sound, thus determined in its pitch by the breadth of the passage. On making the experiment, the result will be found accurately to agree with this explanation. If the sound is predetermined, and the frequency of vibrations such as that each pulse, when doubly reflected, may coincide with the subsequent impulse proceeding directly from the sounding body, the intensity of the sound will be much increased by the reflection; and also, in a less degree, if the reflected pulse coincides with the next but one, the next but two, or more, of the direct pulses. The appropriate notes of a room may readily be discovered by singing the scale in it; and they will be found to depend on the proportion of its length or breadth to 1130 feet. The sound of the stopped diapason pipes of an organ is produced in a manner somewhat similar to the note from an explosion in a passage; and that of its reed pipes to the resonance of the voice in a room: the length of the pipe in one case determining the sound; in the other, increasing its strength. The frequency of the vibrations does not at all immediately depend on the diameter of the pipe. It must be confessed, that much remains to be done in explaining the precise manner in which the vibration of the air in an organ pipe is generated. M. Daniel Bernoulli has solved several difficult problems relating to the subject; yet some of his assumptions are not only gratuitous, but contrary to matter of fact." (*Phil. Trans.* vol. xc. p. 118.)

We shall now close this article with describing a few inventions founded on some of the preceding principles, which may perhaps amuse and not be altogether uninteresting to a number of our readers.

Amusing Experiments and Contrivances.

e con-
sing
tue.

I. Place a concave mirror of about two feet diameter as AB, fig. 11. in a perpendicular direction. The focus of this mirror may be at 15 or 18 inches distance from its surface. At the distance of about five or six feet let there be a partition, in which there is an opening EF, equal to the size of the mirror; against this opening must be placed a picture, painted in water colours, or a thin cloth, that the sound may easily pass through it (G).

Behind the partition, at the distance of two or three feet, place another mirror GH, of the same size as the former, and let it be diametrically opposite to it (H).

At the point C let there be placed the figure of a man seated on a pedestal, and let his ear be placed ex-

actly in the focus of the first mirror: his lower jaw must be made to open by a wire, and shut by a spring; and there may be another wire to move the eyes: these wires must pass through the figure, go under the floor, and come up behind the partition.

Amusing
Experi-
ments, &c.

Let a person, properly instructed, be placed behind the partition near the mirror. You then propose to any one to speak softly to the statue, by putting his mouth to the ear of it, assuring him that it will answer instantly. You then give the signal to the person behind the partition, who, by placing his ear to the focus I, of the mirror GH, will hear distinctly what the other said; and, moving the jaw and eyes of the statue by the wires, will return an answer directly, which will in like manner be distinctly heard by the first speaker.

This experiment appears to be taken from the *Century of Inventions* of the Marquis of Worcester; whose designs, at the time they were published, were treated with ridicule and neglect as being impracticable, but are now known to be generally, if not universally, practicable. The words of the marquis are these: "How to make a brazen or stone head in the midst of a great field or garden, so artificial and natural, that though a man speak ever so softly, and even whisper into the ear thereof, it will presently open its mouth, and resolve the question in French, Latin, Welsh, Irish, or English, in good terms, uttering it out of its mouth, and then shut it until the next question be asked."—The two following, of a similar nature, appear to have been inventions of Kircher, by means of which (as he informs us*) he used to "utter feigned and ludicrous consultations, with a view to show the fallacy and imposture of ancient oracles."

* *Phonurgia Nova*, sect. vi. c. 1.

II. Let there be two heads of plaster of Paris, placed on pedestals, on the opposite sides of a room. There must be a tin tube of an inch diameter, that must pass from the ear of one head, through the pedestal, under the floor, and go up to the mouth of the other. Observe that the end of the tube which is next the ear of the one head, should be considerably larger than that end which comes to the mouth of the other. Let the whole be so disposed that there may not be the least suspicion of a communication.

The com-
municative
busts.

Now, when a person speaks quite low, into the ear of the bust, the sound is reverberated through the length of the tube, and will be distinctly heard by any one who shall place his ear to the mouth of the other. It is not necessary that the tube should come to the lips of the bust.—If there be two tubes, one going to the ear, and the other to the mouth of each head, two persons may converse together by applying their mouth and ear reciprocally to the mouth and ear of the busts; and at the same time other persons that stand in the middle of the chamber, between the heads, will not hear any part of their conversation.

III. Place a bust on a pedestal in the corner of a room, The oracular head.

(G) The more effectually to conceal the cause of this illusion, the mirror AB may be fixed in the wainscot, and a gauze or any other thin covering thrown over it, as that will not in the least prevent the sound from being reflected. An experiment of this kind may be performed in a field or garden, between two hedges, in one of which the mirror AB may be placed, and in the other an opening artfully contrived.

(H) Both the mirrors here used may be of tin or gilt pasteboard, this experiment not requiring such as are very accurate.

Amusing
Experi-
ments, &c.

room, and let there be two tubes, as in the foregoing amusement, one of which must go from the mouth and the other from the ear of the bust, through the pedestal and the floor, to an under apartment. There may be likewise wires that go from the under jaw and the eyes of the bust, by which they may be easily moved.

A person being placed in the under room, and at a signal given applying his ear to one of the tubes, will hear any question that is asked, and immediately reply; moving at the same time, by means of the wires, the mouth and the eyes of the bust, as if the reply came from it.

A solar so-
nata.

IV. In a large case, such as is used for dials and spring clocks, the front of which, or at least the lower part of it, must be of glass, covered on the inside with gauze, let there be placed a barrel organ, which, when wound up, is prevented from playing, by a catch that takes a toothed wheel at the end of the barrel. To one end of this catch there must be joined a wire, at the end of which there is a flat circle of cork, of the same dimension with the inside of a glass tube, in which it is to rise and fall. This tube must communicate with a reservoir that goes across the front part of the bottom of the case, which is to be filled with spirits, such as is used in thermometers, but not coloured, that it may be the better concealed by the gauze.

This case being placed in the sun, the spirits will be rarefied by the heat; and rising in the tube, will lift up the catch or trigger, and set the organ in play: which it will continue to do as long as it is kept in the sun; for the spirits cannot run out of the tube, that part of the catch to which the circle is fixed being prevented from rising beyond a certain point by a check placed over it.

When the machine is placed against the side of a room on which the sun shines strong, it may constantly remain in the same place, if you enclose it in a second case, made of thick wood, and placed at a little distance from the other. When you want it to perform, it will be only necessary to throw open the door of the outer case, and expose it to the sun.

But if the machine be moveable, it will perform in all seasons by being placed before the fire; and in the winter it will more readily stop when removed into the cold.

A machine of this sort is said to have been invented by Cornelius Dreble, in the last century. What the construction of that was, we know not; it might very likely be more complex, but could scarcely answer the intention more readily.

Automa-
tous harp-
sichord.

V. Under the keys of a common harpsichord let there be fixed a barrel, something like that in a chamber organ, with stops or pins corresponding to the tunes you would have it play. These stops must be moveable, so that the tunes may be varied at pleasure. From each of the keys let there go a wire perpendicular down:

the ends of these wires must be turned up for about one-fourth of an inch. Behind these wires let there be an iron bar, to prevent them from going too far back. Now, as the barrel turns round, its pins take the ends of the wires, which pull down the keys, and play the harpsichord. The barrel and wires are to be all enclosed in a case.

In the chimney of the same room where the harpsichord stands, or at least in one adjacent, there must be a smoke jack, from whence comes down a wire, or cord, that, passing behind the wainscot adjoining the chimney, goes under the floor, and up one of the legs of the harpsichord, into the case, and round a small wheel fixed on the axis of that first mentioned. There should be pulleys at different distances, behind the wainscot and under the floor, to facilitate the motion of the cord.

This machinery may be applied to any other keyed instrument as well as to chimes, and to many other purposes where a regular continued motion is required.

An instrument of this sort may be considered as a perpetual motion, according to the vulgar acceptance of the term; for it will never cease going till the fire be extinguished, or some parts of the machinery be worn out.

VI. At the top of a summer-house, or other building, let there be fixed a vane AB, fig. 12. on which is the pinion C, that takes the toothed wheel D, fixed on the axis EF, which at its other end carries the wheel G, that takes the pinion H. All these wheels and pinions are to be between the roof and the ceiling of the building. The pinion H is fixed to the perpendicular axis IK, which goes down very near the wall of the room, and may be covered after the same manner as are bell-wires. At the lower end of the axis IK there is a small pinion L, that takes the wheel M, fixed on the axis of the great wheel NO. In this wheel there must be placed a number of stops, corresponding to the tunes it is to play. These stops are to be moveable, that the tunes may be altered at pleasure. Against this wheel there must hang 12 small bells, answering to the notes of the gamut. Therefore, as the wheel turns round, the stops striking against the bells play the several tunes. There should be a fly to the great wheel, to regulate its motion when the wind is strong. The wheel NO, and the bells are to be enclosed in a case.

There may be several sets of bells, one of which may answer to the tenor, another to the treble, and a third to the bass; or they may play different tunes, according to the size of the wheel. Instead of bells, glasses may be here used, so disposed as to move freely at the stroke of the stops. This machinery may likewise be applied to a barrel-organ; and to many other uses.

A view of the more recent facts and speculations relating to this difficult branch of science will be found under the article ACOUSTICS in the SUPPLEMENT.

A C Q

Acqs.

ACQS, in *Geography*, a town at the foot of the Pyrenean mountains, in the department of Arriege and late province of Foix in France. It takes its name from the hot waters in these parts. E. Long. 1. 45. N. Lat. 42. 40.

A C Q

ACQUAPENDENTE, a pretty large town of Acquapendente Italy, in the territory of the church, and patrimony of St Peter, with a bishop's see. It is seated on a mountain, near the river Paglia, ten miles W. of Orvieto, and 57 N. by W. of Rome. It takes its name from a fall

Fig. 1.

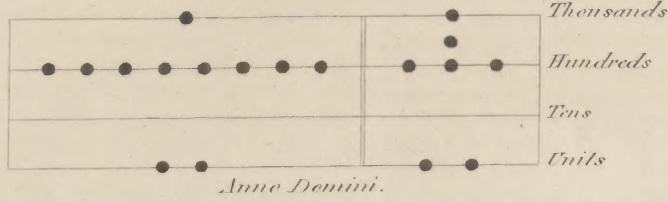
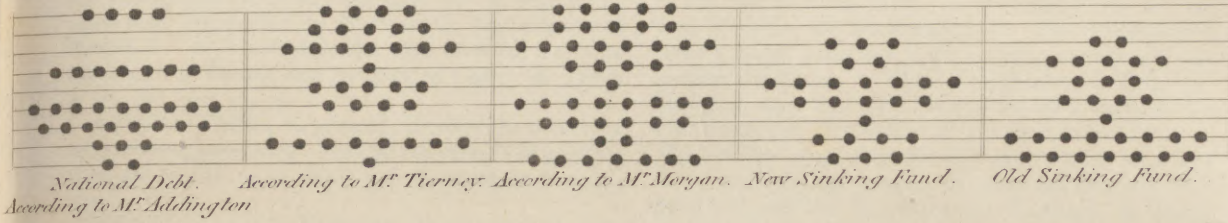


Fig. 2.



ACOUSTICS.

Fig. 1.

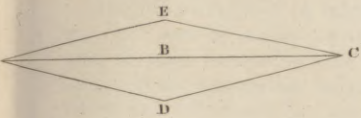


Fig. 2.



Fig. 4.

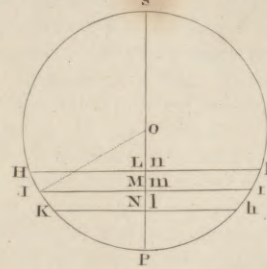


Fig. 3.

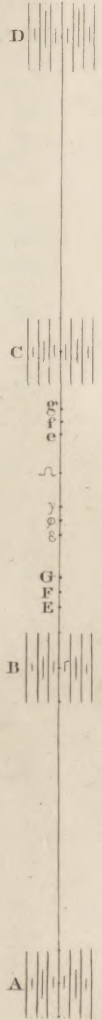


Fig. 5.

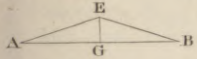


Fig. 6.

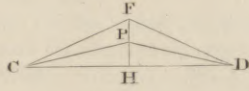


Fig. 7.

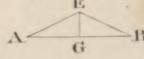


Fig. 10.

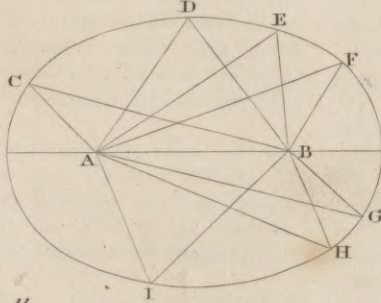


Fig. 9.

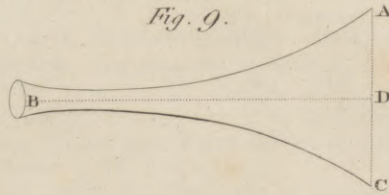


Fig. 8.



Fig. 11.

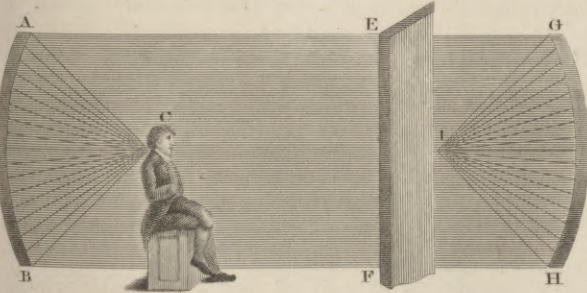
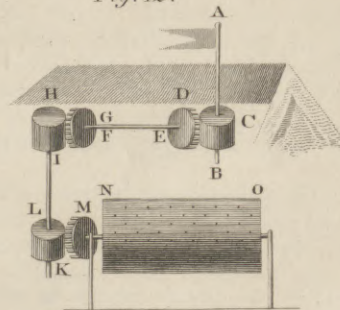


Fig. 12.





fall of water near it, and is now almost desolate. E. Long. 11. 53. N. Lat. 42. 43.

ACQUARIA, a small town of Italy, in Frigana, a district of Modena, which is remarkable for its medicinal waters. It is 18 miles south-west of the city of Modena. E. Long. 10. 45. N. Lat. 44. 24.

ACQUEST, or **ACQUIST**, in *Law*, signifies goods got by purchase or donation. See **CONQUEST**.

ACQUL, a town of Italy, in the duchy of Montferrat, with a bishop's see and commodious baths. It was taken by the Spaniards in 1745, and retaken by the Piedmontese in 1746; but after this it was taken again and dismantled by the French, who afterwards forsook it. It is seated on the river Bormia, 25 miles north-west of Genoa, and 30 south of Casal. E. Long. 8. 19. N. Lat. 44. 4.

ACQUISITION, in general, denotes the obtaining or procuring something. Among lawyers, it is used for the right or title to an estate got by purchase or donation.

ACQUITTAL, a discharge, deliverance, or setting of a person free from the guilt or suspicion of an offence.

ACQUITTANCE, a release or discharge in writing for a sum of money, witnessing that the party has paid the said sum.—No man is obliged to pay a sum of money if the demandant refuses to give an acquittance, which is a full discharge, and bars all actions, &c. An acquittance given by a servant for a sum of money received for the use of his master, shall be a good discharge for that sum, provided the servant used to receive his master's rents, debts, &c.

ACRA, a town of Africa, on the coast of Guinea, where the English, Dutch, and Danes, have strong forts, and each fort has its particular village. W. Long. 0. 2. N. Lat. 5. 0.

ACRA, in *Ancient Geography*, one of the hills of Jerusalem, on which stood the lower town, which was the old Jerusalem; to which was afterwards added Zion, or the city of David. Probably called *Acra*, from the fortress which Antiochus built there in order to annoy the temple, and which Simon Maccabæus took and razed to the ground.

Acra Japygia, in *Ancient Geography*, called *Salentia* by Ptolemy; now *Capo di San Maria di Leuca*: A promontory in the kingdom of Naples, to the south-east of Otranto, where formerly was a town, now lying in ruins, on the Ionian sea, over against the *Montes Acroceraunii* of Epirus.

ACRÆ, in *Ancient Geography*, a town of Sicily, whose inhabitants were called *Acrenses*. It stood to the south of Syracuse, at the distance of 24 miles, near the place now called the monastery of *Santa Maria d'Archia*, on an eminence, as appears from Silius Italicus. The Syracusans were the founders of it, according to Thucydides, 70 years after the building of Syracuse, or 665 before Christ. Hence the epithet *Acræus*.

ACRAGAS, or **AGRAGAS**, in *Ancient Geography*, so called by the Greeks, and sometimes by the Romans, but more generally *Agrigentum* by the latter; a town of Sicily. In Greek medals the inhabitants are called **AKPITANTINOI**, and *Agrigentini* by Cicero. The town stood upon a mountain, at the confluence of the *Acragas* and *Hypsa*, near the port called *Εμπόριον* by Ptolemy, but *Επίριον*, or the Dock, by Strabo; and in

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the time of the latter, scarce a trace of all that side remained. In the year before Christ 584, the people of Gela built *Acragas*, 108 years after building their own city. It took its name from the river running by it; and being but two miles from the sea, enjoyed the conveniences of a sea port. It was a place of great strength, standing on the top of a very steep rock, and washed on the south side by the river *Acragas*, now called *Fiume di Gergenti*, and on the south-west by the *Hypsa*, with a citadel to the south-east, externally surrounded by a deep gulf, which made it inaccessible but on the side next the town. It was famous for the tyrant *Phalaris* and his brazen bull. The *Agrigentines* were a people luxurious in their tables, and magnificent in their dwellings; of whom *Empedocles*, in *Diogenes Laërtius*, says, that they lived to-day as if they were to die to-morrow, and built as if they were to live for ever. The country round the city was laid out in vine and olive yards, in the produce of which they carried on a great and profitable commerce with Carthage. E. Long. 13. 30. N. Lat. 37. 20.

ACRAMAR, or **VAN**, in *Geography*, a town and lake of the greater Armenia in Asia. The town, which is large, populous, and commercial, is the capital of the government of Van, is situated at the foot of the mountains of *Diarbekir*, and is said to have been built by *Semiramis*. The lake abounds with fish. There are two islands in it which are inhabited by religious Armenians. E. Long. 42. 50. N. Lat. 38. 2.

ACRASIA, among physicians, implies the predominancy of one quality above another, either with regard to artificial mixtures, or the humours of the human body. The word is Greek, and compounded of *α* privative, and *κραννυμι*, to mix; *q. d.* not mixed in a just proportion.

ACRASUS, in *Ancient Geography*, a town of Asia Minor in Lydia. Some imperial Greek medals of this city still exist, which were struck under the prætors in honour of Severus, and several other emperors.

ACRATH, in *Ancient Geography*, a place in Mauritania Tingitana, now supposed to be *Velez de Gomara*: A fortified town in the kingdom of Fez, with a citadel and commodious harbour on the Mediterranean, scarce a mile distant from *Penon de Velez*, a Spanish fort. W. Long. 5. N. Lat. 34. 45.

ACRE, or **ACRA**, in *Geography*, a sea-port town in Syria. It was formerly called *Ptolemais*, from one of the Ptolemies: and *Acra* on account of its fortifications; whence the knights of St John of Jerusalem called it St John d'Acre. This city was successively under the dominion of the Romans and the Moors; and was famous in the time of the crusades, and underwent several sieges both by the Christians and Saracens. It is situated at the north angle of a bay, which extends in a semicircle of three leagues, as far as the point of Carmel.

During the crusades, the possession of this town was long disputed by the Christians and Saracens. In 1192 it was taken from the latter by Richard I. of England and Philip of France, after a siege of two years, and the slaughter of 100,000 Christians, beside a greater number who perished by shipwreck or disease, who gave it to the knights of St John of Jerusalem. They kept possession of it 100 years, when it was retaken by the Saracens, and almost entirely destroyed. This

Acragas
||
Acre.

Acre.

event is rendered memorable by an act of singular resolution with which it was accompanied. A number of beautiful young nuns, terrified at the prospect of being exposed to the brutal lust of the infidels, determined to avoid the violation of their chastity, by rendering themselves objects of aversion. With this view they cut off their noses and mangled their faces. The Saracens, inflamed with resentment at a spectacle which prevented the gratification of their appetites, immediately put them all to the sword. After the expulsion of the crusaders, it remained almost deserted till about the year 1750, when it was fortified by Daher, an Arabian scheik, who maintained his independence against the Ottoman power, till the year 1775, when he was basely assassinated by the emissaries of that government at the age of 86 years. He was adored by his people, whom his prudence and valour had through life projected against the tyranny and oppression of the pacha. More lately the works erected by Djezzar, within the last ten years, have rendered it one of the principal towns upon the coast. The mosque of this pacha is boasted as a masterpiece of eastern taste. The bazar, or covered market, is not inferior even to those of Aleppo; and its public fountain surpasses in elegance those of Damascus, though the water is of a very indifferent quality. The pacha has derived the more honour from these works, as he was himself both the engineer and architect: he formed the plans, drew the designs, and superintended the execution.

The port of Acre is one of the best situated on the coast, as it is sheltered from the north and north-west winds by the town itself; but it is greatly choked up since the time of Fakr-el-din. Djezzar contented himself with making a landing place for boats. The fortifications, though more frequently repaired than any other in all Syria, are of no importance: there are only a few wretched low towers near the port, on which cannon are mounted; and these rusty iron pieces are so bad, that some of them burst every time they are fired. Its defence on the land side is merely a garden wall without any ditch.

In the year 1799 Acre was again the scene of war, when it was bravely defended by our gallant countryman Sir Sidney Smith, against the military skill and extraordinary exertions of Bonaparte, and some of his ablest generals. The pacha Djezzar was preparing to evacuate the place, and make good his retreat with his women and treasure, when Sir Sidney with his squadron anchored in the road of Caiffa. The fortifications were repaired under the direction of a skilful engineer, which, with the assistance of the English marines, encouraged and animated the pacha to hold out. After the French had renewed and varied the attack, and been as often repulsed with great slaughter, Bonaparte, despairing of success, raised the siege on the 20th of May, the 61st day after breaking ground.

Corn and cotton form the basis of the commerce of Acre, which is becoming more flourishing every day. Of late, the pacha, by an abuse common throughout all the Turkish empire, has monopolized all the trade in his own hands, no cotton can be sold but to him, and from him every purchase must be made. In vain have the European merchants claimed the privileges granted them by the sultan; Djezzar replied, that he was the sultan in his country, and continued his mo-

nopoly. The merchants were generally French, and they had six houses at Acre, with a consul. The condition of the inhabitants has been much improved since the death of Djezzar, his successor Suleiman being a mild and pacific man.

That part of the bay of Acre in which ships anchor with the greatest security lies to the north of Mount Carmel, below the village of Haifa (commonly called *Caiffa*). The bottom is good holding ground, and does not chafe the cables; but the harbour is open to the north-west wind, which blows violently along all this coast. Mount Carmel, which commands it to the south, is a flattened cone, and very rocky; it is about 1000 feet high. We still find among the brambles wild vines and olive trees, which prove that industry has formerly been employed even in this ungrateful soil: on the summit is a chapel dedicated to the prophet Elias, which affords an extensive prospect over the sea and land. It is 20 miles south of Tyre, and 37 north of Jerusalem. E. Long. 39. 25. N. Lat. 32. 40.

ACRE, in the Mogul's dominions, the same with lack, and signifies the sum of 100,000 rupees; the rupee is of the value of the French crown of three livres, or 30 sols of Holland; 100 lacks of rupees make a couron in Hindostan, or 10,000,000 rupees: the pound sterling is about eight rupees; according to which proportion, a lack of rupees amounts to 12,500l. sterling.

ACRE, the universal measure of land in Britain. The word (formed from the Saxon *acher*, or the German *aker*, a field), did not originally signify a determinate quantity of land, but any open ground, especially a wide champaign; and in this antique sense it seems to be preserved in the names of places, as Castle-acre, West-acre, &c. An acre in England contains four square roods, a rood 40 perches or poles of $16\frac{1}{2}$ feet each by statute. Yet this measure does not prevail in all parts of England, as the length of the pole varies in different counties, and is called *customary measure*, the difference running from the $16\frac{1}{2}$ feet to 28. The acre is also divided into 10 square chains, of 22 yards each, that is, 4840 square yards. An acre in Scotland contains four square roods; one square rood is 40 square falls; one square fall, 36 square ells; one square ell, nine square feet and 73 square inches; one square foot, 144 square inches. The Scots acre is also divided into 10 square chains; the measuring chain should be 24 ells in length, divided into 100 links, each link $8\frac{2}{3}\frac{2}{3}$ inches; and so one square chain will contain 10,000 square links. The English statute acre is about three roods and six falls standard measure of Scotland.

The French acre, *arpent*, contains $1\frac{1}{4}$ English acre, or 54,450 square English feet, whereof the English acre contains only 43,560.—The Strasburg acre is about half an English acre.—The Welsh acre contains commonly two English ones.—The Irish acre is equal to one acre two roods and 19 perches $\frac{2}{3}$ English.

ACRE-Fight, an old sort of duel fought by English and Scottish combatants, between the frontiers of their kingdoms, with sword and lance: it was also called *camp-fight*, and the combatants *champions*, from the open field being the stage of trial.

ACRE-Tax, a tax laid on land at so much per acre. In some places this is also called *acre-shot*. Impositions on lands in the great level are to be raised by a proportionable

portionable acre-tax, 20 Car. II. cap. 8.—An acre-tax of 2s. 6d. per acre, for draining Hadenham-level, 13 Geo. I. cap. 18.

ACRIBEIA, a term purely Greek, literally denoting an exquisite or delicate accuracy; sometimes used in our language, for want of a word of equal signification.

ACRID, a name for any thing that is of a sharp or pungent taste. See MATERIA MEDICA.

ACRIDOPHAGI, in *Ancient Geography*, an Ethiopian people, represented as inhabiting near the deserts, and to have fed on locusts. This latter circumstance their name imports; the word being compounded of the Greek *ακρις* locust, and *φαγω* to eat. We have the following account of them by Diodorus Siculus*. Their stature was lower than that of other men; they were meagre, and extremely black. In the spring, high west winds drove from the desert to their quarter locusts of an extraordinary size, and remarkable for the squalid colour of their wings. So great was the number of these insects, that they were the only sustenance of the barbarians, who took them in the following manner: At the distance of some stadia from their habitations there was a wide and deep valley. They filled this valley with wood and wild herbs, with which their country abounded. When the cloud of locusts appeared, which was driven on by the wind, they set fire to the fuel which they had collected. The smoke which arose from this immense fire was so thick, that the locusts in crossing the valley, were stifled by it, and fell in heaps on the ground. The passage of the locusts being thus intercepted for many days, they made a large provision of those insects. As their country produced great quantities of salt, they salted them, to render them more palatable, and to make them keep till the next season. This peculiar supply was their sole food: they had neither herds nor flocks. They were unacquainted with fishing; for they lived at a distance from the sea. They were very active, and ran with great swiftness. But their life was not of long duration; it exceeded not forty years. The close of their life was extremely miserable; for in their old age, winged lice of different, but all of ugly forms, bred in their bodies. This malady, which began in the breast and belly, soon spread through the whole frame. The patient at first felt an itching; and the agreeable sensation produced by his scratching of himself, preceded a most deplorable calamity. For when those lice, which had bred in his body, forced their way out, they caused effusions of corrupt blood, with excruciating pains in the skin. The unhappy man, with lamentable cries, was industrious himself to make passages for them with his nails. In short these lice issued forth successively from the wounds made by the hands of the patient, as from a vessel full of holes, and in such numbers that it was impossible to exterminate them.—Whether this extraordinary and dreadful distemper was occasioned by the food of the inhabitants of this country, or by a pestilential quality of their climate, it is difficult to determine. Indeed, as to the credibility of the whole account, we must leave the reader to judge.

But though the circumstances of these people should be deemed fabulous, yet may the *acridophagia* be true. It is well known, that to this day the inhabitants of

Ethiopia, Arabia, &c. frequently use locusts for food. *Acridophagi.* The reader will not be displeased if we lay before him the result of Dr Hasselquist's inquiries as to this particular, who travelled in Syria and Egypt so late as the year 1752. This ingenious gentleman, who travelled with a view to improve natural history, informs us, that he asked Franks, and many other people who had lived long in these countries, whether they had ever heard that the inhabitants of Arabia, Ethiopia, &c. used locusts as food? They answered that they had. He likewise asked the same question of Armenians, Copts, and Syrians, who lived in Arabia, and had travelled in Syria, and near the Red sea; some of whom said they heard of such a practice, and others that they had often seen the people eat these insects. He at last obtained complete satisfaction on this head from a learned scheik at Cairo, who had lived six years in Mecca. This gentleman told him, in presence of M. le Grand the principal French interpreter at Cairo, and others, that a famine frequently rages at Mecca when there is a scarcity of corn in Egypt, which obliges the inhabitants to live upon coarser food than ordinary: That when corn is scarce, the Arabians grind the locusts in hand mills, or stone mortars, and bake them into cakes, and use these cakes instead of bread: That he has frequently seen locusts used by the Arabians, even when there was no scarcity of corn; but then they boil them, stew them with butter, and make them into a kind of fricassee; which he says is not disagreeably tasted, for he had sometimes tasted these locust fricassees out of curiosity.

A later traveller, Dr Sparrman, informs us*, ** Voyage to the Cape, vol. i. p. 36.* "That locusts sometimes afford a high treat to the more unpolished and remote hordes of the Hottentots; when, as sometimes happens, after an interval of 8, 10, 15, or 20 years, they make their appearance in incredible numbers. At these times they come from the north, migrating to the southward, and do not suffer themselves to be impeded by any obstacles, but fly boldly on, and are drowned in the sea whenever they come to it. The females of this race of insects, which are most apt to migrate, and are chiefly eaten, are said not to be able to fly; partly by reason of the shortness of their wings, and partly on account of their being heavy and distended with eggs; and shortly after they have laid these in the sand, they are said to die. It is particularly of these that the Hottentots make a brown coffee-coloured soup, which at the same time acquires from the eggs a fat and greasy appearance. The Hottentots are highly rejoiced at the arrival of these locusts, though they are sure to destroy every bit of verdure on the ground: but the Hottentots make themselves ample amends for this loss, by falling foul on the animals themselves, eating them in such quantities as in the space of a few days to get visibly fatter and in better condition than before."

The Abbé Poiret, also, in his Memoir on the Insects of Barbary and Numidia, informs us, "That the Moors make locusts a part of their food; that they go to hunt them; fry them in oil and butter; and sell them publicly at Tunis, at Bonne," &c.

From these accounts, we may see the folly of that dispute among the divines about the nature of St John's food in the wilderness: some maintaining the original word to signify the fruits of certain trees; others, a kind

Acridophaga of birds, &c. : but those who adhered to the literal meaning of the text were at least the most orthodox, although their arguments were perhaps not so strong as they might have been, had they had an opportunity of quoting such authors as the above.

ACRII MONTES, in *Ancient Geography*, mountains in the island of Sicily which are also called *Heræi*.

ACRILLÆ, a city of Sicily between Aciræ and Agrigentum, not far from Syracuse, supposed to be the same with Acila which is mentioned by Plutarch.

ACRISIUS, in fabulous history, king of Argos, being told by the oracle that he should be killed by his grandchild, shut up his only daughter Danaë in a brazen tower: but Jupiter coming down in a golden shower, begot Perseus upon her. After Perseus had slain the Gorgons, he carried Medusa's head to Argos; which Acrisius seeing, was turned into a statue.

ACRISTIA, in *Geography*, a town of Sicily, 23 miles west-north-west of Magara. It is built on the ruins of the ancient town of Schritea.

ACRITAS, in *Ancient Geography*, a promontory of Messenia, running into the sea, and forming the beginning of the bay of Messene. Now called *Capo de Gallo*, between Methone to the west, and Corone to the east, where the Sinus Coronæus begins.

ACROAMATIC, or ACROATIC, in general, denotes a thing sublime, profound, or abstruse.

ACROAMATICI, a denomination given to the disciples or followers of Aristotle, &c. who were admitted into the secrets of the inner or acroamatic philosophy.

ACROATHOUM, or ACROTHOUM, in *Ancient Geography*, a town situated on the top of Mount Athos, where the inhabitants, according to Mela, were longer lived by half than in any other country; called by the modern Greeks, *Αγιος αγιος*; by the Italians *La Cima di Monte Santo*.

ACROATIC is a name given to Aristotle's lectures to his disciples, which were of two kinds, *exoteric* and *acroatic*. The acroatic were those to which only his own disciples and intimate friends were admitted; whereas the exoteric were public and open to all. But there are other differences. The acroatic were set apart for the higher and more abstruse subjects; the exoteric were employed in rhetorical and civil speculations. Again, The acroatics were more subtle and exact, evidence and demonstration being here aimed at; the exoterics chiefly aimed at the probable and plausible. The former were the subject of the morning exercises in the Lyceum, the latter of the evenings. Besides, the exoterics were published: whereas the acroatics were kept secret; being either entirely concealed, or, if they were published, it was in such obscure terms, that few but his own disciples could be the wiser for them. Hence, when Alexander complained of his preceptor for publishing his acroatics, and thus revealing what should have been reserved to his disciples, Aristotle answered, that they were made public and not public; for that none who had not heard them explained by the author *viva voce*, could understand them.

ACROBATES, in antiquity, were rope-dancers who performed various feats by vaulting or tumbling on a rope; sliding down on a rope from a lofty station

with arms and legs extended, in imitation of flying; and running, dancing, and leaping, on a rope stretched horizontally.

ACROBATICA, or ACROBATICUM, from *ακρος*, high, and *βασις*, or *βαινα*, I go; an ancient engine whereby people were raised aloft, that they might see more conveniently about them. The *acrobatika* among the Greeks amounted to the same with what they call *scansorium* among the Latins. Authors are divided as to the use of this engine. Turnebus and Barbarus take it to have been of the military kind, raised by besiegers, high enough to overlook the walls, and discover the state of things on the other side. Baldus rather supposes it a kind of moveable scaffold, or cradle, contrived for raising painters, plasterers, and other workmen, to the tops of houses, trees, &c. Some suspect that it might have been used for both purposes; which is the opinion of Vitruvius and Aquinas.

ACROCERAUNIA, or MONTES CERAUNII, in *Ancient Geography*, mountains running out into the sea (so called from their being often thunderstruck), separating the Ionian sea from the Adriatic; where Illyria ends and Epirus begins: now called *Monti della Chimera*.

ACROCHERISMUS, among the Greeks, a sort of gymnastic exercise, in which the two combatants contended with their hands and fingers only, without closing or engaging the other parts of the body.

ACROCORINTHUS, in *Ancient Geography*, a high and steep hill, hanging over the city of Corinth, which was taken within the walls, as an acropolis, or citadel. On its top stood a temple of Venus; and lower down issued the fountain Priene.

ACROMION, in *Anatomy*, the upper part of the scapula or shoulder blade. See ANATOMY.

ACROMONOGRAMMATICUM, in *Poetry*, a kind of poem, wherein every subsequent verse begins with the letter wherewith the immediately preceding one terminated.

ACRON, a celebrated physician of Agrigentum, in Sicily, who lived about the middle of the fifth century before Christ. He first thought of lighting large fires, and purifying the air with perfumes, to put a stop to the pestilence that ravaged Athens, and which was attended with success. He wrote two treatises, according to Suidas, in the Doric dialect; the one on physic, and the other on abstinence or diet.

ACRON, in *Geography*, a territory on the Gold coast of Guinea, in Africa, bordering on the Fanynean country. The Dutch have a fort here called Fort Patience; and under it is a village, inhabited only by fishermen. The other inhabitants are addicted to husbandry, and sell their corn to other countries. There is plenty of game, which is very commodious for the Dutch factory. The people are very ignorant, and go naked like the rest of the negroes. This is called Little Acron; for Great Acron is farther inland, and is a kind of a republic.

ACRONICAL, ACHRONYCAL, or ACHRONICAL, in *Astronomy*, is a term applied to the rising of a star, when the sun is set in the evening; but has been promiscuously used to express a star's rising at sunset, or setting at sunrise.

ACRONIUS LACUS (Mela); a small lake formed by the Rhine, soon after its rise out of the Alps, and after

Acrobates
Acronius

Aconius
||
Acrostoli-
um.

after passing the greater lake at Constance, called *Venetus*, and now the *Bodensee*, or lake of Constance.

ACROPOLIS, in *Ancient Geography*, the citadel, and one of the divisions of Athens; called *Polis*, because constituting the first and original city; and the *Upper Polis*, to distinguish it from the lower, which was afterwards built round it in a large open plain, the Acropolis standing on a rock or eminence in the heart of this plain; and hence its name: To the north it had a wall built by the Pelasgi, and therefore called *Pelasgic*; and to the south a wall, by Cimon the son of Miltiades, out of the Persian spoils, many ages after the building of the north wall. It had nine gates, and was therefore called *Eneapylon*; yet but one principal gate or entrance, the ascent to which was by a flight of steps of white marble, built in a magnificent manner by Pericles, (Plutarch).

ACROPOLITA, **GEORGE**, one of the writers in the Byzantine history, was born at Constantinople, in the year 1220, and educated at the court of the emperor John Ducas at Nice. He was employed in the most important affairs of the empire; being sent ambassador to Larissa, to establish a peace with Michael of Epirus; and was constituted judge to try Michael Comnenus, who was suspected of engaging in a conspiracy. Theodorus Lascaris, the son of John, whom he had taught logic, appointed him governor of all the western provinces in his empire. In 1255, he was taken prisoner in a war with Michael Angelus; but gaining his liberty in 1260, by means of the emperor Palæologus, he was sent by him ambassador to Constantine prince of Bulgaria; and was employed in several other negotiations. He wrote, *A Continuation of the Greek History*, from the taking of Constantinople by the Latins till it was recovered by Michael Palæologus in 1261, which makes part of the Byzantine history; *A Treatise concerning Faith, Virtue, and the Soul*; *An Exposition of the Sermons of St Gregory Nazianzen*, and other pieces. Gregory Cyprian, patriarch of Constantinople, in his encomium upon him, prefixed to Acropolita's history, is perhaps somewhat extravagant in his praise, when he says he was equal to Aristotle in philosophy, and to Plato in the knowledge of divine things and Attic eloquence.

ACROSPIRE, a vulgar term for what botanists call the *plumes*.

ACROSPIRED, in malt-making, is the grain's shooting both at the root and blade end.

ACROSTIC, in *Poetry*, a kind of poetical composition, disposed in such a manner, that the initial letters of the verses form the name of some person, kingdom, place, motto, &c. The word is compounded of the Greek *akros*, *extremity*, and *sixos*, *verse*. The acrostic is considered by the critics as a species of false wit, and is therefore very little regarded by the moderns.

ACROSTICHUM, **RUSTYBACK**, **WALL-RUE**, or **FORK-FERN**. See *BOTANY Index*.

ACROSTOLIUM, in ancient naval architecture, the extreme part of the ornament used on the prows of ships, which was sometimes in the shape of a buckler, helmet, animal, &c. but more frequently circular, or spiral. It was usual to tear them from the prows of vanquished vessels, and fix them to the conquerors, as a

signal of victory. They were frequently represented on the reverse of ancient medals.

ACROTELEUTIC, among ecclesiastic writers, an appellation given to any thing added to the end of a psalm; as the *Gloria Patri*, or *Doxology*.

ACROTHERI, in *Geography*, a small town in the island of Santorin. N. Lat. 36. 25. E. Long. 26. 1.

ACROTHERIA, in *Architecture*, small pedestals, usually without bases, anciently placed at the middle or two extremes of pediments or frontispieces, serving to support the statues, &c. It also signifies the figures placed as ornaments on the tops of churches, and the sharp pinnacles that stand in ranges about flat buildings with rails and balusters.

Among ancient physicians, it signified the larger extremities of the body, as the head, hands, and feet. It has also been used for the tips of the fingers, and sometimes for the eminences or processes of bones.

ACROTHYMION, from *akros*, *extreme*, and *thymos*, *thyme*. A sort of wart described by Celsus as hard and rough, with a narrow basis and broad top; the top is of the colour of thyme; it easily splits and bleeds. This tumour is also called *thymus*.

ACT, in general, denotes the exertion of power; and differs from power, as the effect from the cause.

ACT, in *Logic*, is particularly understood of an operation of the human mind. Thus to discern and examine, are acts of the understanding; to judge and affirm, are acts of the will. There are voluntary and spontaneous acts; the former are produced by the operation of the soul, the latter without its privity or participation.

ACT, in the universities, signifies a thesis maintained in public by a candidate for a degree; or to show the capacity and proficiency of a student. The candidates for a degree of bachelor and master of arts are to hold philosophical acts; and those for bachelor of divinity, theological acts, &c. At Oxford, the time when masters or doctors complete their degrees, is also called the *act*; which is held with great solemnity. At Cambridge, they call it the *commencement*.

Act of Faith, Auto da Fe, in the Romish church, is a solemn day held by the inquisition, for the punishment of heretics, and the absolution of the innocent accused*. They usually contrive the *Auto* to fall on some great festival, that the execution may pass with the more awe and regard; at least it is always on a Sunday.

The *Auto da Fe* may be called the last act of the inquisitorial tragedy; it is a kind of gaol-delivery, appointed as oft as a competent number of prisoners in the inquisition are convicted of heresy, either by their own voluntary or extorted confession, or on the evidence of certain witnesses. The process is thus: In the morning they are brought into a great hall, where they have certain habits put on, which they are to wear in the procession. The procession is led up by Dominican friars; after which come the penitents, some with san-benitos, and some without, according to the nature of their crimes; being all in black coats without sleeves, and barefooted, with a wax candle in their hands. These are followed by the penitents who have narrowly escaped being burnt, who over their black coats have flames painted with their points turned downwards,

Acrostolium
||
Act.

Act.

wards, *Fuego revolto*. Next come the negative and relapsed, who are to be burnt, having flames on their habits pointing upwards. After these come such as profess doctrines contrary to the faith of Rome, who, besides flames pointing upwards, have their picture painted on their breasts, with dogs, serpents, and devils, all open-mouthed, about it. Each prisoner is attended with a familiar of the inquisition; and those to be burnt have also a Jesuit on each hand, who are continually preaching to them to abjure. After the prisoners comes a troop of familiars on horseback; and after them the inquisitors, and other officers of the court, on mules; last of all, the inquisitor-general on a white horse, led by two men with black hats and green hat-bands. A scaffold is erected in the *Terriero de Paco*, big enough for two or three thousand people; at one end of which are the prisoners, at the other the inquisitors. After a sermon made up of encomiums of the inquisition, and invectives against heretics, a priest ascends a desk near the middle of the scaffold, and having taken the abjuration of the penitents, recites the final sentence of those who are to be put to death; and delivers them to the secular arm, earnestly beseeching at the same time the secular power not to touch their blood, or put their lives in danger. The prisoners being thus in the hands of the civil magistrate, are presently loaded with chains, and carried first to the secular gaol, and from thence in an hour or two brought before the civil judge; who, after asking in what religion they intend to die, pronounces sentence, on such as declare they die in the communion of the church of Rome, that they shall be first strangled, and then burnt to ashes; on such as die in any other faith, that they be burnt alive. Both are immediately carried to the Ribera, the place of execution; where there are as many stakes set up as there are prisoners to be burnt, with a quantity of dry furze about them. The stakes of the professed, that is, such as persist in their heresy, are about four yards high, having a small board towards the top for the prisoner to be seated on. The negative and relapsed being first strangled and burnt, the professed mount their stakes by a ladder; and the Jesuits, after several repeated exhortations to be reconciled to the church, part with them, telling them they leave them to the devil, who is standing at their elbow to receive their souls, and carry them with him into the flames of hell. On this a great shout is raised; and the cry is, Let the dogs beards be made; which is done by thrusting flaming furzes fastened to long poles against their faces, till their faces are burnt to a coal, which is accompanied with the loudest acclamations of joy. At last, fire is set to the furze at the bottom of the stake, over which the professed are chained so high, that the top of the flame seldom reaches higher than the seat they sit on; so that they rather seem roasted than burnt. There cannot be a more lamentable spectacle; the sufferers continually cry out, while they are able, *Misericordia per amor de Dios*, "Pity for the love of God!" yet it is beheld by all sexes and ages with transports of joy and satisfaction.

ACT, in dramatic poetry, signifies a certain division or part of a play, designed to give some respite both to the actors and spectators. The Romans were the first who divided their theatrical pieces into acts; for no such divisions appear in the works of the first dra-

matic poets. Their pieces indeed consisted of several parts or divisions, which they called *protasis*, *epitasis*, *catastasis*, and *catastrophe*; but these divisions were not marked by any real interruptions in the theatre. Nor does Aristotle mention any thing of acts in his Art of Poetry. But, in the time of Horace, all regular and finished pieces were divided into five acts.

*Neve minor, neu sit quinto productior actu
Fabula, quæ posci vult, et spectata reponi.*

If you would have your play deserve success,
Give it five acts complete, nor more nor less.

FRANCIS.

The first act, according to some critics, besides introducing upon the stage the principal characters of the play, ought to propose the argument or subject of the piece; the second, to exhibit this to the audience, by carrying the fable into execution; the third, to raise obstacles and difficulties; the fourth, to remove these, or raise new ones in the attempt; and the fifth, to conclude the piece, by introducing some accident that may unravel the whole affair. This division, however, is not essentially necessary; but may be varied according to the humour of the author, or the nature of the subject. See POETRY.

Act of Grace. See GRACE.

ACT, among lawyers, is an instrument in writing for declaring or justifying the truth of any thing. In which sense, records, decrees, sentences, reports, certificates, &c. are called *acts*.

ACTS also denote the deliberations and resolutions of an assembly, senate, or convention; as acts of parliament, &c. Likewise matters of fact transmitted to posterity in certain authentic books and memoirs.

ACTA Consistorii, the edicts or declarations of the council of state of the emperors. These edicts were generally expressed in such terms as these: "the august emperors, *Dioclesian* and *Maximin*, in council declared, That the children of decurions should not be exposed to wild beasts in the amphitheatre."

The senate and soldiers often swore, either through abject flattery or by compulsion, upon the *edicts* of the emperor, as we do upon the *Bible*. And the name of *Apidius Merula* was erased by Nero out of the register of senators, because he refused to swear upon the edicts of the emperor Augustus.

ACTA Diurna, was a sort of Roman gazette, containing an authorized narrative of the transactions worthy of notice which happened at Rome. Petronius has given us a specimen of the *acta diurna* in his account of Trimalchi; and as it may not perhaps be unentertaining to see how exactly a Roman newspaper runs in the style of an English one, the following is an article or two out of it:

"On the 26th of July, 30 boys and 40 girls were born at Trimalchi's estate at Cuma.

"At the same time a slave was put to death for uttering disrespectful words against his lord.

"The same day a fire broke out in Pompey's gardens, which began in the night, in the steward's apartment."

ACTA Populi, among the Romans, were journals or registers of the daily occurrences; as assemblies, trials, executions, buildings, births, marriages, deaths, &c.

of

Act.
Acta.

Acts. of illustrious persons, and the like. These were otherwise called *Acta Publica* and *Acta Diurna*, or simply *Acta*. The *Acta* differed from *Annals*, in that only the greater and more important matters were in the latter, and those of less note were in the former. Their origin is attributed to Julius Cæsar, who first ordered the keeping and making public the acts of the people. Some trace them higher, to Servius Tullius; who, to discover the number of persons born, dead, and alive, ordered that the next of kin, upon a birth, should put a certain piece of money into the treasury of Juno Lucina; upon a death, into that of Venus Libitina: the like was also to be done upon assuming the toga virilis, &c. Under Marcus Antoninus, this was carried further: persons were obliged to notify the births of their children, with their names and surnames, the day, consul, and whether legitimate or spurious, to the prefects of the *Ærarium Saturni*, to be entered in the public acts; though before this time the births of persons of quality appear thus to have been registered.

Acta Senatus, among the Romans, were minutes of what passed and was debated in the senate house. These were also called *Commentarii*, and by a Greek name *ἱστορικὰ*. They had their origin in the consulship of Julius Cæsar, who ordered them both to be kept and published. The keeping them was continued under Augustus, but the publication was abrogated. Afterwards all writings, relating to the decrees or sentences of the judges, or what passed and was done before them, or by their authority, in any cause, were also called by the name *Acta*: In which sense we read of civil acts, criminal acts, intervenient acts; *acta civilia, criminalia, intervenientia, &c.*

Public Acts. The knowledge of public acts forms part of a peculiar science, called the DIPLOMATIC, of great importance to a historian, statesman, chronologer, and even critic. The preservation of them was the first occasion of erecting libraries. The style of acts is generally barbarous Latin. Authors are divided as to the rules of judging of their genuineness, and even whether there be any certain rules at all. F. Germon will have the greater part of the acts of former ages to be spurious. Fontanini asserts, that the number of forged acts now extant, is very small. It is certain there were severe punishments inflicted on the forgers and falsifiers of acts.—The chief of the English acts, or public records, are published by Rymer, under the title of *Fœdera*, and continued by Saunderson; an extract whereof has been given in French by Rapin, and translated into English under the title of *Acta Regia*. Great commendations have been given this work: also some exceptions made to it; as that there are many spurious acts, as well as errors, in it; some have even charged it with falsifications.—The public acts of France fell into the hands of the English after the battle of Poitiers, and are commonly said to have been carried by them out of the country. But the tradition is not supported by any sufficient testimony.

Acts of the Apostles, one of the sacred books of the New Testament, containing the history of the infant church, during the space of 29 or 30 years from the ascension of our Lord to the year of Christ 63.—It was written by St Luke; and addressed to Theophilus, the person to whom the evangelist had before dedicated his Gospel. We here find the accomplishment of several of

the promises made by our Saviour; his ascension; the descent of the Holy Ghost; the first preaching of the apostles, and the miracles whereby their doctrines were confirmed; an admirable picture of the manners of the primitive Christians; and, in short, every thing that passed in the church till the dispersion of the apostles, who separated themselves in order to propagate the gospel throughout the world. From the period of that separation, St Luke quits the history of the other apostles, who were then at too great a distance from him, and confines himself more particularly to that of St Paul, who had chosen him for the companion of his labours. He follows that apostle in all his missions, and even to Rome itself; for it appears that the Acts were published in the second year of St Paul's residence in that city, or the 36th year of the Christian era, and in the 9th or 10th year of Nero's reign. The style of this work, which was originally composed in Greek, is much purer than that of the other canonical writers; and it is observable that St Luke, who was much better acquainted with the Greek than with the Hebrew language, always, in his quotations from the Old Testament, makes use of the Septuagint version. The council of Laodicea places the Acts of the Apostles among the canonical books, and all the churches have acknowledged it as such without any controversy.

There were several *Spurious ACTS* of the APOSTLES; particularly, 1. *Acts*, supposed to be written by Abdias*, the pretended bishop of Babylon, who gave out that he was ordained bishop by the apostles themselves when they were upon their journey into Persia. 2. *The Acts of St Peter*: this book came originally from the school of the Ebionites. 3. *The Acts of St Paul*; which is entirely lost. Eusebius, who had seen it, pronounces it of no authority. 4. *The Acts of St John the Evangelist*; a book made use of by the Encratites, Manichæans, and Priscillianists. 5. *The Acts of St Andrew*; received by the Manichæans, Encratites, and Apotactics. 6. *The Acts of St Thomas the Apostle*; received particularly by the Manichæans. 7. *The Acts of St Philip*. This book the Gnostics made use of. 8. *The Acts of St Matthias*. Some have imagined that the Jews for a long time had concealed the original Acts of the life and death of St Matthias written in Hebrew; and that a monk of the abbey of St Matthias at Treves, having got them out of their hands, procured them to be translated into Latin, and published them; but the critics will not allow them to be authentic.

Acts of Pilate; a relation sent by Pilate to the emperor Tiberius, concerning Jesus Christ, his death, resurrection, ascension, and the crimes of which he was convicted before him†. It was a custom among the Romans, that the proconsuls and governors of provinces should draw up acts, or memoirs, of what happened in the course of their government, and send them to the emperor and senate. The genuine acts of Pilate were sent by him to Tiberius, who reported them to the senate; but they were rejected by that assembly, because not immediately addressed to them: as is testified by Tertullian, in his Apol. cap. 5. and 20, 21. The heretics forged acts in imitation of them: in the reign of the emperor Maximin, the Gentiles, to throw an odium on the Christian name, spread about spurious Acts of Pilate: which the emperor, by a solemn edict, ordered.

Acts.

* Sec Abdias.

† Eusebii Hist. Eccl. lib. ii. cap. 2. and ix. 5.

Act
||
Actio.

ordered to be sent into all the provinces of the empire, and enjoined the schoolmasters to teach and explain them to their scholars, and make them learn them by heart. These acts, both the genuine and the spurious, are lost. There is indeed extant, in the Pseudo-Hege-sippus, a letter from Pilate to the emperor Claudius, concerning Jesus Christ *; but it discovers itself at first sight not to be authentic.

* Cave Hist.
Literar.
Sæc. Apo-
stol.

Act of Parliament is a positive law, consisting of two parts, the words of the act, and its true sense and meaning; which being joined, make the law. The words of acts of parliament should be taken in a lawful sense. Cases of the same nature are within the intention, though without the letter, of the act: and some acts extend by equity to things not mentioned therein. See PARLIAMENT.

ACTÆ, were meadows of remarkable verdure and luxuriance near the sea-shore, where the Romans used to indulge themselves to a great degree in softness and delicacy of living. The word is used in this sense by Cicero and Virgil; but Vossius thinks it can only be used in speaking of Sicily, as these two authors did.

ACTÆA, HERB-CHRISTOPHER, or BANE-BERRIES: See BOTANY Index.

ACTÆON, in fabulous history, the son of Aristæus and Autonoe: a great hunter. He was transformed by Diana into a stag, because he looked on her while bathing; and was devoured by his own dogs. The effects of impertinent curiosity and expensive pleasures seem to be the moral of the fable.

ACTANIA, an island, according to Pliny, in the North sea. It lies to the west of Holstein and Dithmarsch, not far from the mouth of the Eyder and Elbe, and is now called *Heyligland*.

ACTE. See *SAMBUCUS*.

ACTIAN GAMES, in Roman antiquity, were solemn games instituted by Augustus, in memory of his victory over Mark Antony at Actium, held every fifth year, and celebrated in honour of Apollo, since called *Actius*. Hence *Actian Years*, an era commencing from the battle of Actium, called the *Era of Augustus*.

Virgil insinuates them to have been instituted by Æneas; from that passage, *Æn.* III. v. 280.

Actique Iliacis celebramus littora ludis.

ÆN. III. 280.

But this he only does by way of compliment to Augustus: attributing that to the hero from whom he descended, which was done by the emperor himself; as is observed by Servius.

ACTINIA, in Zoology, a genus belonging to the order of Vermes mollusca, called *Animal Flowers*, and *Sea Anemonies*. See *VERMES*.

ACTINOLITE, in Mineralogy. See *MINERALOGY Index*.

ACTIO, in Roman antiquities, an action at law in a court of justice. The formalities used by the Romans, in judicial actions, were these: If the difference failed to be made up by friends, the injured person proceeded *in jus reum vocare*, to summon the offending party to the court, who was obliged to go, or give bond for his appearance.

The offending party might be summoned into court *viva voce*, by the plaintiff himself meeting the defendant, declaring his intention to him, and commanding

him to go before the magistrate and make his defence. If he would not go willingly, he might drag and force him along, unless he gave security for his appearance on some appointed day. If he failed to appear on the day agreed on, then the plaintiff, whensoever he met him, might take him along with him by force, calling any by-standers to bear witness, by asking them *visne antestari*? the by-standers upon this turned their ear toward him in token of their consent: To this Horace alludes in his satire against the impertinent, Lib. i. Sat. 9. See this further explained under the article *ANTESTARI*.

Both parties being met before the prætor, or other supreme magistrate presiding in the court, the plaintiff proposed the action to the defendant, in which he designed to prosecute him. This they termed *edere actionem*; and was commonly performed by writing it in a tablet, and offering it to the defendant, that he might see whether he had better stand the suit or compound.

In the next place came the *postulatio actionis*, or the plaintiff's petition to the prætor, for leave to prosecute the defendant in such an action. The petition was granted by writing at the bottom of it *actionem do*, or refused by writing in the same manner *actionem non do*.

The petition being granted, the plaintiff *vadabatur reum*, i. e. obliged him to give sureties for his appearance on such a day in the court; and this was all that was done in public, before the day fixed upon for the trial.

In the mean time, the difference was often made up, either *transactio*, by letting the cause fall as dubious; or *pactio*, by composition for damages amongst friends.

On the day appointed for hearing, the prætor ordered the several bills to be read, and the parties summoned by an *accensus*, or beadle. See *ACCENSI*.

Upon the nonappearance of either party, the defaulter lost his cause: if they both appeared, they were said *se stetisse*; and then the plaintiff proceeded *litem sive actionem intendere*, i. e. to prefer his suit, which was done in a set form of words, varying according to the difference of the actions. After this the plaintiff desired judgment of the prætor, that is, to be allowed a *judex* or *arbiter*, else the *recuperatores* or *centumviri*. These he requested for the hearing and deciding the business: but none of them could be desired but by the consent of both parties.

The prætor having assigned them their judges, defined and determined the number of witnessess to be admitted, to hinder the protracting of the suit; and then the parties proceeded to give their caution, that the judgment, whatever it was, should stand and be performed on both sides. The judges took a solemn oath to be impartial: and the parties took the *juramentum calumnie*. Then the trial began with the assistance of witnesses, writings, &c. which was called *disceptatio causæ*.

ACTION, in a general sense, implies nearly the same thing with *ACT*.—Grammarians, however, observe some distinction between *action* and *act*; the former being generally restricted to the common or ordinary transactions, whereas the latter is used to express those which are remarkable. Thus, we say it is a good *action*

Actio,
Action.

action. *action* to comfort the unhappy ; it is a generous *act* to deprive ourselves of what is necessary for their sake. The wise man proposes to himself an honest end in all his actions ; a prince ought to mark every day of his life with some act of greatness. The abbé Girard makes a further distinction between the words *action* and *act*. The former, according to him, has more relation to the power that acts than the latter ; whereas the latter has more relation to the effect produced than the former : and hence the one is properly the attribute of the other. Thus we may properly say, " Be sure to preserve a presence of mind in all your actions ; and take care that they be all acts of equity."

ACTION, in *Mechanics*, implies either the effort which a body or power makes against another body or power, or the effect itself of that effort.

As it is necessary, in works of this kind, to have a particular regard to the common language of mechanics and philosophers, we have given this double definition : but the proper signification of the term is the motion which a body really produces, or tends to produce, in another ; that is, such is the motion it would have produced, had nothing hindered its effect.

All power is nothing more than a body actually in motion, or which tends to move itself ; that is, a body which would move itself if nothing opposed it. The action therefore of a body is rendered evident to us by its motion only ; and consequently we must not fix any other idea to the word action, than that of actual motion, or a simple tendency to motion. The famous question relating to *vis viva* and *vis mortua*, owes, in all probability, its existence to an inadequate idea of the word action : for had Leibnitz and his followers observed, that the only precise and distinct idea we can give to the word force or action, reduces it to its effect, that is, to the motion it actually produces or tends to produce, they would never have made that curious distinction.

Quantity of ACTION, a name given by M. de Maupertuis, in the Memoirs of the Parisian Academy of Sciences for 1744, and those of Berlin for 1746, to the product of the mass of a body by the space which it runs through, and by its celerity. He lays it down as a general law, " that, in the changes made in the state of a body, the quantity of action necessary to produce such change is the least possible." This principle he applies to the investigation of the laws of refraction, of equilibrium, &c. and even to the ways of acting employed by the Supreme Being. In this manner M. de Maupertuis attempts to connect the metaphysics of final causes with the fundamental truths of mechanics, to show the dependence of the collision of both elastic and hard bodies upon one and the same law, which before had always been referred to separate laws ; and to reduce the laws of motion, and those of equilibrium, to one and the same principle.

ACTION, in *Ethics*, denotes the external signs or expressions of the sentiments of a moral agent. See *ACTIVE Power*, *infra*.

ACTION, in *Poetry*, the same with subject or fable. Critics generally distinguish two kinds, the principal and the incidental. The principal action is what is generally called the *fable* ; and the incidental an *episode*. See *POETRY*.

ACTION, in *Oratory*, is the outward deportment of
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the orator, or the accommodation of his countenance, voice, and gesture, to the subject of which he is treating. See *ORATORY*.

ACTION, in a theatrical sense. See *DECLAMATION*.

ACTION for the Pulpit. See *DECLAMATION*.

ACTION, in *Painting* and *Sculpture*, is the attitude or position of the several parts of the face, body, and limbs, of such figures as are represented, and whereby they seem to be really actuated by passions. Thus we say, the action of such a figure finely expresses the passions with which it is agitated ; we also use the same expression with regard to animals.

ACTION, in *Physiology*, is applied to the functions of the body, whether vital, animal, or natural.

The vital functions, or actions, are those which are absolutely necessary to life, and without which there is no life : as the action of the heart, lungs, and arteries. On the action and reaction of the solids and fluids on each other, depend the vital functions. The pulse and respiration are the external signs of life. Vital diseases are all those which hinder the influx of the venous blood into the cavities of the heart, and the expulsion of the arterial blood from the same.—The natural functions are those which are instrumental in repairing the several losses which the body sustains ; for life is destructive of itself, its very offices occasioning a perpetual waste. The manducation of food, the deglutition and digestion thereof, also the separation and distribution of the chyle and excrementitious parts, &c. are under the head of natural functions, as by these our aliment is converted into our nature. They are necessary to the continuance of our bodies.—The animal functions are those which we perform at will, as muscular motion, and all the voluntary actions of the body : they are those which constitute the senses of touch, taste, smell, sight, hearing, perception, reasoning, imagination, memory, judgment, affections of the mind. Without any or all of them, a man may live, but not so comfortably as with them.

ACTION, in *Commerce*, is a term used abroad for a certain part or share of a public company's capital stock. Thus, if a company has 400,000 livres capital stock, this may be divided into 400 actions, each consisting of 1000 livres. Hence a man is said to have two, four, &c. actions, according as he has the property of two, four, &c. 1000 livres capital stock. The transferring of actions abroad is performed much in the same manner as stocks are with us. See *STOCKS*.

ACTION, in *Law*, is a demand made before a judge for obtaining what we are legally entitled to demand, and is more commonly known by the name of *law-suit* or *process*. See *SUIT*.

ACTIONARY, or **ACTIONIST**, a proprietor of stock in a trading company.

ACTIONS, among merchants, sometimes signify moveable effects ; and we say the merchant's creditors have seized on all his actions, when we mean that they have taken possession of all his active debts.

ACTIVE, denotes something that communicates action or motion to another ; in which acceptation it stands opposed to passive.

ACTIVE, in *Grammar*, is applied to such words as express action ; and is therefore opposed to passive. The active performs the action, as the passive receives it.

Action
||
Active.

Active
||
Action.

Thus we say, a verb *active*, a conjugation *active*, &c. or an *active* participle.

ACTIVE Verbs, are such as do not only signify doing, or acting, but have also nouns following them, to be the subject of the action or impression: Thus, *To love, to teach*, are verbs *active*; because we can say, *To love a thing, to teach a man*. Neuter verbs also denote an action, but are distinguished from active verbs: in that they cannot have a noun following them: such are, *To sleep, to go*, &c. Some grammarians, however, make three kinds of active verbs: the *transitive*, where the action passes into a subject different from the agent; *reflected*, where the action returns upon the agent; and *reciprocal*, where the action returns mutually upon the two agents who produced it.

ACTIVE Power, in *Metaphysics*, the power of executing any work or labour; in contradistinction to *speculative powers**, or the powers of seeing, hearing, remembering, judging, reasoning, &c.

The exertion of active power we call *action*; and as every action produces some change, so every change must be caused by some effect, or by the cessation of some exertion of power. That which produces a change by the exertion of its power we call the *cause* of that change; and the change produced, the *effect* of that cause. See *METAPHYSICS*.

ACTIVE Principles, in *Chemistry*, such as are supposed to act without any assistance from others; as mercury, sulphur, &c.

ACTIVITY, in general, denotes the power of acting, or the active faculty. See *ACTIVE*.

Sphere of ACTIVITY, the whole space in which the virtue, power, or influence, of any object is exerted.

ACTIUM, in *Ancient Geography*, a town situated on the coast of Acarnania, in itself inconsiderable, but famous for a temple of Apollo, a safe harbour, and an adjoining promontory of the same name, in the mouth of the Sinus Ambracius, over against Nicopolis, on the other side of the bay: it afterwards became more famous on account of Augustus's victory over Antony and Cleopatra; and for quinquennial games instituted there, called *Actia* or *Ludi Actiaci*. Hence the epithet *Actius*, given to Apollo (Virgil). *Actiaca æra*, a computation of time from the battle of Actium. The promontory is now called *Capo di Figalo*. The medals of Actium were silver, gold and bronze; and the ordinary type is a flying pegasus.

ACTIUS, in mythology, a surname of Apollo, from Actium, where he was worshipped.

ACTON, a town near London, where is a well that affords a purging water, which is noted for the pungency of its salt. This water is whitish; to the taste it is sweetish, with a mixture of the same bitter which is in the Epsom water. The salt of this water is not quite so soft as that of Epsom; and is more calcareous than it, having more of the salt of lime: for a quantity of the Acton water being boiled high, and mixed with a solution of sublimate in pure water, threw down a yellow sediment. The salt of the Acton water is more nitrous than that of Epsom; it strikes a deep red, or purple, with the tincture of logwood in brandy, as is usual with nitrous salts; it does not precipitate silver out of the spirit of nitre, as common salt does: $1\frac{1}{2}$ lb. of this water yields 48 grains of salt.

ACTOR, in general, signifies a person who acts or performs something.

ACTOR, among civilians, the proctor or advocate in civil courts or causes; as, *Actor ecclesie* has been sometimes used for the advocate of the church; *actor dominicus* for the lord's attorney; *actor villæ*, the steward or head bailiff of a village.

ACTOR, in the drama, is a person who represents some part or character in the theatre. The drama consisted originally of nothing more than a simple chorus, who sung hymns in honour of Bacchus; so that the primitive actors were only singers and musicians. Thespis was the first that, in order to ease this uniformed chorus, introduced a declaimer, who repeated some heroic or comic adventure. Æschylus, finding a single person tiresome, attempted to introduce a second, and changed the ancient recitals into dialogues. He also dressed his actors in a more majestic manner, and introduced the cothurnus or buskin. Sophocles added a third, in order to represent the various incidents in a more natural manner: and here the Greeks stopped, at least we do not find in any of their tragedies above three persons in the same scene. Perhaps they looked upon it as a rule of the dramatic poem never to admit more than three speakers at a time on the stage; a rule which Horace has expressed in the following verse:

Nec quarta loqui persona laboret.

This, however, did not prevent their increasing the number of actors in comedy. Before the opening of a play, they named their actors in full theatre, together with the parts they were to perform. The ancient actors were masked, and obliged to raise their voice extremely, in order to make themselves heard by the innumerable crowd of people who filled the amphitheatres: they were accompanied with a player on the flute, who played a prelude, gave them the tone, and played while they declaimed. Horace speaks of a kind of secondary actors in his time, whose business was to imitate the first; and lessen themselves, to become better foils to their principals.

The moderns have introduced an infinite number of actors upon the stage. This heightens the trouble and distress that should reign there, and makes a diversity, in which the spectator is sure to be interested.

Actors were highly honoured at Athens. At Rome they were despised, and not only denied all rank among the citizens, but even when any citizen appeared upon the stage, he was expelled his tribe, and deprived of the right of suffrage by censors. Cicero, indeed, esteems the talents of Roscius: but he values his virtues still more; virtues which distinguished him so remarkably above all others of his profession, that they seemed to have excluded him from the theatre. The French have, in this respect, adopted the ideas of the Romans; and the English those of the Greeks.

ACTOR, the name of several persons in fabulous history. One *Actor* among the Aurunci is described by Virgil as a hero of the first rank. *Æn.* xii.

ACTORUM TABULÆ, in antiquity, were tables instituted by Servius Tullius, in which the births of children were registered. They were kept in the treasury of Saturn.

ACTRESS,

* Dr Reid
on the Ac-
tive Powers
of Man,
p. 12.

Actress
||
Actuarius.

ACTRESS, in a general sense, a female who acts or performs something.

ACTRESS, in the *Drama*, a female performer. Women actors were unknown to the ancients, among whom men always performed the female character; and hence one reason for the use of masks among them.

Actresses are said not to have been introduced on the English stage till after the restoration of King Charles II. who has been charged with contributing to the corrupting of our manners by importing this usage from abroad. But this can be but partly true: the queen of James I. acted a part in a pastoral; and Prynne, in his *Histriomastix*, speaks of women actors in his time as prostitutes; which was one occasion of the severe prosecution brought against him for that book.

There are some very agreeable and beautiful talents, of which the possession commands a certain sort of admiration; but of which the exercise for the sake of gain is considered, whether from reason or prejudice, as a sort of public prostitution. The pecuniary recompense, therefore, of those who exercise them in this manner, must be sufficient, not only to pay for the time, labour, and expence of acquiring the talents, but for the discredit which attends the employment of them as the means of subsistence. The exorbitant rewards of players, opera-singers, opera-dancers, &c. are founded upon those two principles; the rarity and beauty of the talents, and the discredit of employing them in this manner. It seems absurd at first sight that we should despise their persons, and yet reward their talents with the most profuse liberality. While we do the one, however, we must of necessity do the other. Should the public opinion or prejudice ever alter with regard to such occupations, their pecuniary recompense would quickly diminish. More people would apply to them, and the competition would quickly reduce the price of their labour. Such talents, though far from being common, are by no means so rare as is imagined. Many people possess them in great perfection, who disdain to make this use of them; and many more are capable of acquiring them, if any thing could be made honourably by them.

ACTUAL, something that is real and effective, or that exists truly and absolutely. Thus philosophers use the terms *actual heat*, *actual cold*, &c. in opposition to *virtual* or *potential*. Hence, among physicians, a red hot iron, or fire, is called an actual cautery; in distinction from cauteries, or caustics, that have the power of producing the same effect upon the animal solids as actual fire, and are called *potential* cauteries. Boiling water is actually hot; brandy, producing heat in the body, is potentially hot, though of itself cold.

ACTUAL Sin, that which is committed by the person himself; in opposition to *original sin*, or that which he contracted from being a child of Adam.

ACTUARIÆ NAVES, a kind of long and light ships among the Romans, thus denominated, because they were chiefly designed for swiftness and expedition. They correspond to what the French call *brigantines*.

ACTUARIUS, a celebrated Greek physician of the 13th century, and the first Greek author who has treated of mild purgatives, such as cassia, manna, sena, &c. He is the first also who mentions distilled waters.

His works were printed in one volume folio, by Henry Stephens in 1567.

ACTUARIUS, or ACTARIUS, a notary or officer appointed to write the acts or proceedings of a court, or the like. In the Eastern empire, the actuarii were properly officers, who kept the military accounts, received the corn from the *susceptores* or storekeepers, and delivered it to the soldiers.

ACTUATE, to bring into act, or put a thing in action. Thus an agent is said, by the schoolmen, to *actuate* a power, when it produces an act in a subject. Thus the mind may be said to *actuate* the body; and thus a medicine is said by some ancient physicians to be actuated or brought into action, when by means of the vital heat it is made to produce its effect.

ACTUS, in *Ancient Architecture*, a measure in length equal to 120 Roman feet. In *Ancient Agriculture* the word signified the length of one furrow, or the distance a plough goes before it turns.

Actus Minimus was a quantity of land 120 feet in length, and four in breadth.

Actus Major, or *Actus Quadratus*, a piece of ground in a square form, whose side was equal to 120 feet, equal to half the jugerum.

Actus Intervicinalis, a space of ground four feet in breadth, left between the lands as a path or way.

ACUANITES, in *Ecclesiastical History*, the same with those called more frequently MANICHEES. They took the name from Aeuia, a disciple of Thomas one of the twelve apostles.

ACULEATE, or ACULEATI, a term applied to any plant or animal armed with prickles.

ACULEI, the prickles of animals or of plants.

ACULER, in the *Mangee*, is used for the motion of a horse, when, in working upon volts, he does not go far enough forward at every time or motion, so that his shoulders embrace or take in too little ground, and his croupe comes too near the centre of the volt. Horses are naturally inclined to this fault in making demi-volts.

ACUMINA, in *Antiquity*, a kind of military omen, most generally supposed to have been taken from the points or edges of darts, swords, or other weapons.

ACUNA, CHRISTOPHER DE, a Spanish Jesuit, born at Burgos. He was admitted into the society in 1612, being then but 15 years of age. After having devoted some years to study, he went to America, where he assisted in making converts in Chili and Peru. In 1640 he returned to Spain, and gave the king an account how far he had succeeded in the commission he had received to make discoveries on the river of the Amazons; and the year following he published a description of this river at Madrid. Acuna was sent to Rome, as procurator of his province. He returned to Spain with the title of Qualificator of the Inquisition; and was at Lima in 1675, when Father Southwell published at Rome the *Bibliothèque* of the Jesuit writers. Acuna's work is entitled, *Neuvo descubrimiento del gran río de las Amazonas*; i. e. "A new discovery of the great river of the Amazons." He was 10 months together upon this river, having had instructions to inquire into every thing with the greatest exactness, that his majesty might thereby be enabled to render the navigation more easy and commodious. He

Actuarius
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Acuna.

Acuna
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Ad

went aboard a ship at Quito with Peter Texiera, who had already been so far up the river, and was therefore thought a proper person to accompany him in this expedition. They embarked in February 1639, but did not arrive at Para till the December following. It is thought that the revolution of Portugal, by which the Spaniards lost all Brazil, and the colony of Para at the mouth of the river of the Amazons, were the cause that the relation of this Jesuit was suppressed; for, as it could not be of any advantage to the Spaniards, they were afraid it might prove of great service to the Portuguese. The copies of this work became extremely scarce, so that the publishers of the French translation at Paris asserted, that there was not one copy of the original extant, excepting one in the possession of the translator, and perhaps that in the Vatican library. M. de Gomberville was the author of this translation: it was published after his death, with a long dissertation. An account of the original may be seen in the Paris Journal, in that of Leipsic, and in Cheverau's History of the World.

ACUPUNCTURE, the name of a surgical operation among the Chinese and Japanese, which is performed by pricking the part affected with a silver needle. They employ this operation in headaches, lethargies, convulsions, colics, &c.

ACUS, in *Ichthyology*, the trivial name of a species of syngnathus. See SYNGNATHUS.

ACUSIO COLONIA, now **ANCONE**, according to Holstenius, between Orange and Valence, near Montelimart, on the banks of the Rhone.

ACUTE, an epithet applied to such things as terminate in a sharp point or edge. And in this sense it stands opposed to obtuse.

ACUTE Angle, in *Geometry*, is that which is less than a right angle, or which does not subtend 90 degrees.

ACUTE-angled Triangle, is a triangle whose three angles are all acute.

ACUTE-angled Cone, is, according to the ancients, a right cone, whose axis makes an acute angle with its side.

ACUTE, in *Music*, is applied to a sound or tone that is sharp or high in comparison of some other tone. In this sense, *acute* stands opposed to *grave*.

ACUTE Accent. See **ACCENT**.

ACUTE Diseases, such as come suddenly to a crisis. This term is used for all diseases which do not fall under the head of chronic diseases.

ACUTIATOR, in writers of the barbarous ages, denotes a person that whets or grinds cutting instruments; called also in ancient glossaries *acutor*, *acutarius*, *samiarius*, *coharius*, &c. In the ancient armies there were acutiatores, a kind of smiths, retained for whetting or keeping the arms sharp.

AD, a Latin preposition, originally signifying *to*, and frequently used in composition both with and without the *d*, to express the relation of one thing to another.

Ad Bestias, in antiquity, is the punishment of criminals condemned to be thrown to wild beasts.

Ad Hominem, in *Logic*, a kind of argument drawn from the principles or prejudices of those with whom we argue.

Ad Ludos, in antiquity, a sentence upon criminals

among the Romans, whereby they were condemned to entertain the people by fighting either with wild beasts or with one another, and thus executing justice upon themselves.

Ad Metalla, in antiquity, the punishment of such criminals as were condemned to the mines, among the Romans; and therefore called *Metallici*.

Ad Valorem, a term chiefly used in speaking of the duties or customs paid for certain goods: The duties on some articles are paid by the number, weight, measure, tale, &c.; and others are paid *ad valorem*, that is, according to their value.

ADAGE, a proverb, or short sentence, containing some wise observation or popular saying. Erasmus has made a very large and valuable collection of the Greek and Roman adages; and Mr Ray has done the same with regard to the English. We have also Kelly's Collection of Scots Proverbs.

ADAGIO, in *Music*. Adverbially, it signifies *softly*, *leisurely*: and is used to denote the slowest of all times. Used substantively, it signifies a slow movement. Sometimes this word is repeated, as *adagio*, *adagio*, to denote a still greater retardation in the time of the music.

ADALIDES, in the Spanish policy, are officers of justice, for matters touching the military forces. In the laws of King Alphonsus, the adalides are spoken of as officers appointed to guide and direct the marching of the forces in time of war. Lopez represents them as a sort of judges, who take cognizance of the differences rising upon excursions, the distribution of plunder, &c.

ADAM, the first of the human race, was formed by the Almighty on the sixth day of the creation. His body was made of the dust of the earth: after which, God animated or gave it life, and Adam then became a rational creature. His heavenly Parent did not leave his offspring in a destitute state to shift for himself; but planted a garden, in which he caused to grow not only every tree that was proper for producing food, but likewise such as were agreeable to the eye, or merely ornamental. In this garden were assembled all the brute creation; and, by their Maker, caused to pass before Adam, who gave all of them names, which were judged proper by the Deity himself.—In this review Adam found none for a companion to himself. This solitary state was seen by the Deity to be attended with some degree of unhappiness; and therefore he threw Adam into a deep sleep, in which condition he took a rib from his side, and healing up the wound formed a woman of the rib he had taken out. On Adam's awaking, the woman was brought to him; and he immediately knew her to be one of his own species, called her his bone and his flesh, giving her the name of *woman* because she was taken out of man.

The first pair being thus created, God gave them authority over the inferior creation, commanding them to subdue the earth, also to increase and multiply and fill it. They were informed of the proper food for the beasts and for them; the grass, or green herbs, being appointed for beasts; and fruits, or seeds, for man. Their proper employment also was assigned them; namely, *to dress the garden, and to keep it*.

Though Adam was thus highly favoured and instructed by his Maker, there was a single tree, which grew

Ad
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Adam.

Adam. in the middle of the garden, of the fruit of which they were not allowed to eat; being told that they should surely die in the day they ate of it. This tree was named the *Tree of the Knowledge of Good and Evil*. This prohibition, however, they soon broke through. The woman having entered into conversation with the *Serpent*, was by him persuaded, that by eating of the tree she should become as wise as God himself: and accordingly, being invited by the beauty of the fruit, and its desirable property of imparting wisdom, she plucked and ate; giving her husband of it at the same time, who did likewise eat.

Before this transgression of the divine command, Adam and his wife had no occasion for clothes, neither had they any sense of shame; but immediately on eating the forbidden fruit, they were ashamed of being naked, and made aprons of fig leaves for themselves. On hearing the voice of God in the garden, they were terrified, and hid themselves: but being questioned by the Deity, they confessed what they had done, and received sentence accordingly; the man being condemned to labour; the woman to subjection to her husband, and to pain in child-bearing. They were now driven out of the garden, and their access to it prevented by a terrible apparition. They had clothes given them by the Deity made of the skins of beasts. In this state Adam had several children; the names of only three of whom we are acquainted with, viz. Cain, Abel, and Seth. He died at the age of 930 years.

These are all the particulars concerning Adam's life, that we have on divine authority: but a vast multitude of others are added by the Jews, Mahometans, and Papists; all of which must be at best conjectural; most of them, indeed, appear downright falsehoods or absurdities. The curiosity of our readers, it is presumed, will be sufficiently gratified by the few which are here subjoined.

According to the Talmudists, when Adam was created, his body was of immense magnitude. When he sinned, his stature was reduced to a hundred ells, according to some; to nine hundred cubits, according to others; who think this was done at the request of the angels, who were afraid of so gigantic a creature. In the island of Ceylon is a mountain, called the *Peak* or mountain of Adam, from its being, according to the tradition of the country, the residence of our first parents. Here the print of his footsteps, above two palms in length, are still pointed out.

Many reveries have been formed concerning the personal beauty of Adam. That he was a handsome well-shaped man is probable; but some writers, not content with this, affirm, that God, intending to create man, clothed Himself with a perfectly beautiful human body, making this his model in the formation of the body of Adam.

Nor has the imagination been less indulgent concerning the formation of the human species male and female.—It would be endless to recount all the fancies that have been wrote on this subject; but as Madame Bourignon has made a considerable figure in the *religious*, or rather *superstitious*, world, we cannot help inserting some of her opinions concerning the first man, which are peculiarly marvellous. According to the *revelations* of this lady, Adam before his fall possessed in himself the principles of both sexes, and the virtue

or power of producing his like, without the concurrent assistance of woman. The division into two sexes she imagined*, was the consequence of man's sin; and now, she observes, mankind are become so many *monsters in nature*, being much less perfect in this respect than plants or trees, which are capable of producing their like alone, and without pain or misery. She even imagined, that being in an ecstasy, she saw the figure of Adam before he fell, with the manner how, by himself, he was capable of procreating other men. "God," says she, "represented to my mind the beauty of the first world, and the manner how he had drawn it from the chaos: every thing was bright, transparent and darted forth life and ineffable glory. The body of Adam was purer and more transparent than crystal, and vastly flcet; through his body were seen vessels and rivulets of light, which penetrated from the inward to the outward parts, through all his pores. In some vessels ran fluids of all kinds and colours, vastly bright, and quite diaphanous. The most ravishing harmony arose from every motion; and nothing resisted, or could annoy him. His stature was taller than the present race of men; his hair was short, curled, and of a colour inclining to, black; his upper lip covered with short hair: and instead of the bestial parts which modesty will not allow us to name, he was fashioned as our bodies will be in the life eternal, which I know not whether I dare reveal. In that *region* his nose was formed after the manner of a *face*, which diffused the most delicious fragrancy and perfumes; whence also men were to issue, all whose principles were inherent in him: there being in his belly a vessel, where little eggs were formed; and a second vessel filled with a fluid which impregnated those eggs: and when man heated himself in the love of God, the desire he had that other creatures should exist beside himself, to praise and love God, caused the fluid above mentioned (by means of the fire of the love of God), to drop on one or more of these eggs, with inexpressible delight; which being thus impregnated, issued, some time after, out of man by this canal†, in the shape of an egg;‡ i. e. the whence a perfect man was hatched by insensible degrees. Woman was formed by taking out of Adam's side the vessels that contained the eggs; which she still possesses, as is discovered by anatomists."

Many others have believed that Adam at his first creation was both male and female: others, that he had two bodies joined together at the shoulders, and their faces looking opposite ways like those of Janus. Hence, say these, when God created Eve, he had no more to do than to separate the two bodies from one another§. Of all others, however, the opinion of Paracelsus seems the most ridiculous||. *Negabat primos parantes antelapsam habuisse partes generationi hominis necessarias; credebat postea accessisse, ut strumam gutturi.*

Extravagant things are asserted concerning Adam's knowledge. It is very probable that he was instructed by the Deity how to accomplish the work appointed him, viz. to dress the garden, and keep it from being destroyed by the brute creatures; and it is also probable that he had likewise every piece of knowledge communicated to him that was either necessary or pleasing: but that he was acquainted with geometry, mathematics, rhetoric, poetry, painting, sculpture, &c. is too ridiculous to be credited by any sober person. Some rabbies,

Adam.
* Preface to a book, entitled *Le nouveau Ciel et la nouvelle Terre*, Amst. 1679,

† i. e. the nasal canal situated as above described.

† See *An. drogynes.*
|| Paracelsus apud Vossium de *Philosophia*, c. ix. p. 71.

Adam.

rabbies, indeed, have contented themselves with equaling Adam's knowledge to that of Moses and Solomon; while others, again, have maintained that he excelled the angels themselves. Several Christians seem to be little behind these Jews in the degree of knowledge they ascribe to Adam, nothing being hid from him, according to them, except contingent events relating to futurity. One writer indeed (Pinedo) excepts politics; but a Carthusian friar, having exhausted in favour of Aristotle, every image and comparison he could think of, at last asserted that Aristotle's knowledge was as extensive as that of Adam.—In consequence of this surprising knowledge with which Adam was endued, he is supposed to have been a considerable author. The Jews pretend that he wrote a book on the creation, and another on the Deity. Some rabbies ascribe the 92d psalm to Adam; and in some manuscripts the Chaldee title of this psalm expressly declares that this is the song of praise which the first man repeated for the Sabbath day.

Various conjectures have been formed concerning the place where man was first created, and where the garden of Eden was situated; but none of these have any solid foundation. The Jews tell us, that Eden was separated from the rest of the world by the ocean; and that Adam, being banished therefrom, walked across the sea, which he found every way fordable, by reason of his enormous stature*. The Arabians imagined paradise to have been in the air; and that our first parents were thrown down from it on their transgression, as Vulcan is said to have been thrown down headlong from heaven by Jupiter.

Strange stories are told concerning Adam's children. That he had none in the state of innocence, is certain from Scripture; but that his marriage with Eve was not consummated till after the fall, cannot be proved from thence. Some imagine, that, for many years after the fall, Adam denied himself the connubial joys by way of penance; others, that he cohabited with another woman, whose name was LILLITH. The Mahometans tell us, that our first parents having been thrown headlong from the celestial paradise, Adam fell upon the isle of Serendib, or Ceylon, in the East Indies; and Eve on Iodda, a port of the Red sea, not far from Mecca. After a separation of upwards of 200 years, they met in Ceylon, where they multiplied: according to some Eve had twenty, according to others only eight, deliveries; bringing forth at each time twins, a male and a female, who afterwards married. The rabbins imagine that Eve brought forth Cain and Abel at a birth; that Adam wept for Abel a hundred years in the valley of tears near Hebron, during which time he did not cohabit with his wife; and that this separation would probably have continued longer, had it not been forbid by the angel Gabriel. The inhabitants of Ceylon affirm, that the salt lake on the mountain of Colombo consists wholly of the tears which Eve for one hundred years together shed because of Abel's death.

Some of the Arabians tell us, that Adam was buried near Mecca on Mount Abukobeis; others, that Noah, having laid his body in the ark, caused it to be carried after the deluge to Jerusalem by Melchisedeck the son of Shem: of this opinion are the eastern Christians; but the Persians affirm that he was interred

in the isle of Serendib, where his corpse was guarded by lions at the time the giants warred upon one another. Some are of opinion that he was buried at Jerusalem, on the place where Christ suffered, that so his bones might be sprinkled with the Saviour's blood.

ADAM, *Alexander*, late rector of the high school of Edinburgh, and author of several useful works. See SUPPLEMENT.

ADAM, *Melchior*, lived in the 17th century. He was born in the territory of Grotkaw in Silesia, and educated in the college of Brieg, where the dukes of that name, to the utmost of their power, encouraged learning and the reformed religion as professed by Calvin. Here he became a firm Protestant; and was enabled to pursue his studies by the liberality of a person of quality, who had left several exhibitions for young students. He was appointed rector of a college at Heidelberg, where he published his first volume of illustrious men in the year 1615. This volume, which consisted of philosophers, poets, writers on polite literature, and historians, &c. was followed by three others: that which treated of divines was printed in 1619; that of the lawyers came next; and, finally, that of the physicians: the two last were published in 1620. All the learned men, whose lives are contained in these four volumes, lived in the 16th, or beginning of the 17th century, and are either Germans or Flemings; but he published in 1618 the lives of twenty divines of other countries in a separate volume. All his divines are Protestants. The Lutherans were not pleased with him, for they thought him partial; and will not allow his work to be a proper standard of the learning of Germany. He was the author of several other works besides his lives. His industry as a biographer is commended by Bayle, who acknowledges his obligations to his labours. He died in 1622.

ADAM, *Robert*, an eminent architect, was born at Edinburgh in the year 1728. He was the second son of William Adam, Esq. of Maryburgh, in the county of Fife, who has also left some respectable specimens of his genius and abilities as an architect in Hope-toun house, and the Royal Infirmary of Edinburgh, which were erected from designs executed by him. And it was perhaps owing to the fortunate circumstance of his father's example that young Adam first directed his attention to those studies, in the prosecution of which he afterwards rose to such distinguished celebrity. He received his education at the university of Edinburgh, where he had an opportunity of improving and enlarging his mind, by the conversation and acquaintance of some of the first literary characters of the age, who were then rising into reputation, or have since established their fame as historians and philosophers. Among these were Mr Hume, Dr Robertson, Dr Smith, and Dr Ferguson, who were the friends and companions of the father, and who continued through life their friendship and attachment to the son.

In the year 1754 Mr Adam travelled to the continent, with a view to extend his knowledge and improve his taste in architecture, and resided in Italy for three years. Here he surveyed and studied those noble specimens of ancient grandeur which the magnificent public edifices of the Romans, even in ruins, still exhibit. But he saw with regret, that the public buildings, constructed with more durable materials and greater

* This is just the picture of the Orion or Polyphemus of the poets. *Æneid*. iii. 663, 664. x. 763.

Adam. greater strength and solidity, had alone been able to resist, during the lapse of ages, the injuries of time, and the more destructive hand of the northern barbarians, whose progress was marked with ruin and desolation. Not a vestige of any of the private buildings of the wealthy citizens, which have been described and celebrated by their writers for their magnificence, now remains; and even the situation of some of the splendid villas of the luxurious Romans is scarcely known. In tracing the progress of architecture and the other fine arts among the Romans, Mr Adam observed that they had visibly declined previous to the time of Dioclesian; but he was also convinced that the liberal patronage and magnificence of that emperor had revived during his reign a better taste for architecture, and had formed artists who were capable of imitating the more elegant stile of a purer age. He had seen this remarkably exemplified in the public baths at Rome, which were erected by him, the most entire and the noblest of the ancient buildings. Admiring the extent and fertility of genius of the artists, from whose designs such magnificent structures had been executed, he was anxious to see and study any remains that yet existed of those masters whose works are striking monuments of an elegant and improved taste, but whose names, amid the wrecks of time, have sunk into oblivion. It was with this view that he undertook a voyage to Spalatro, in Dalmatia, to visit and examine the private palace of Dioclesian, in which that emperor resided for nine years previous to his death, and to which he retired in the year 305, when he resigned the government of the empire. Mr Adam sailed from Venice in July 1754, accompanied by M. Clerisseau, a French artist and antiquarian, and two experienced draughtsmen. On their arrival at Spalatro, they found that though the palace had suffered much from the injuries of time, yet it had sustained no less from the dilapidations of the inhabitants to procure materials for building, and even the foundations of the ancient structure were covered with modern houses. With high expectations of success, they commenced their labours, but were soon interrupted by the jealous vigilance of the government. Suspecting that their object was to view and make plans of the fortifications, an immediate and peremptory order was issued by the governor, commanding them to desist. This order, however, was soon counteracted through the mediation of General Græme, the commander in chief of the Venetian forces; and they were permitted to proceed in their undertaking. They resumed their labours with double ardour, and in five weeks finished plans and views of the fragments which remain, from which they were enabled to execute perfect designs of the entire building.

Mr Adam now returned to England, and soon rose to very considerable professional eminence. In 1762 he was appointed architect to the king, and the year following he presented to the public the fruit of his voyage to Spalatro, in a splendid work dedicated to his majesty, which contains engravings and descriptions of the ruins of the palace. A later traveller, the Abbé Fortis, speaking of the ruins of this palace, says, "I will not pretend to mention the great Roman remains, for which this noble city is chiefly known and celebrated. The lovers of architecture and antiquity are sufficiently acquainted with them by the work of Mr

Adam, who has done full justice to these superb vestiges by his elegant drawings and engravings. In general, however, the coarseness of the work, and the bad taste of the age are equal to the magnificence of the buildings. For all this, I do not mean to detract from the merit of the august remains of Dioclesian's palace. I count them among the most respectable monuments of antiquity now extant." And the historian of the Decline and Fall of the Roman Empire, in consequence of this observation, after having expressed a high commendation of the work, has thrown out a suspicion of the accuracy of the representations and descriptions. "For the account of Dioclesian's palace, says Mr Gibbon, we are indebted to an ingenious artist of our own time and country, whom a very liberal curiosity had carried into the heart of Dalmatia. But there is room to suspect that the elegance of his designs and engravings has somewhat flattered the objects which it was their purpose to represent. We are informed by a more recent and very judicious traveller, that the awful ruins of Spalatro are not less expressive of the decline of the arts, than of the greatness of the Roman empire in the time of Dioclesian." Mr Gibbon's criticism is scarcely supported by the observation of the Abbé Fortis; and what the latter has advanced on this subject is not perfectly consistent with itself: for while he censures the coarseness of the work and the bad taste of the age, he bestows something like indirect praise, when he adds that, he means not to detract from the merit of the august remains of this edifice, and regards it as one of the most respectable monuments of antiquity now extant. The apparent coarseness of the work is probably owing to the effects of the weather, which have destroyed the smooth polish of the chissel which it originally received; and Mr Adam allows, that, previous to this period of the Roman empire, the arts had visibly declined, but at the same time contends, that the buildings erected in the reign of Dioclesian, exhibit convincing proofs of the stile and manner of a purer age. But of this, the admirer of this elegant art may judge for himself, by consulting the engravings and descriptions, the accuracy and faithfulness of which there seems to be no reason to doubt.

In the year 1768 Mr Adam obtained a seat in parliament. He was chosen to represent the county of Kinross; and about the same time he resigned his office of architect to the king. But he continued his professional career with increasing reputation; and about the year 1773, in conjunction with his brother James, who also rose to considerable eminence as an architect, he published another splendid work, consisting of plans and elevations of public and private buildings which were erected from their designs. Among these are Lord Mansfield's house at Caenwood, Luton house in Bedfordshire belonging to Lord Bute, the new Gateway of the Admiralty Office, the Register Office at Edinburgh, &c. which are universally admired as precious monuments of elegant design and correct taste. The Adelphi buildings at London, which are also striking examples of the inventive genius of the Messrs Adam, proved an unsuccessful speculation. The wealth and power of a nation were perhaps only equal to so extensive an undertaking: it was too great to be attempted by private citizens.

The buildings which have been more lately erected from

Adam.

Adam.

from the designs of Mr Adam, afford additional proofs of the unlimited extent of his invention, and the amazing fertility of his genius. Those parts of the new University of Edinburgh which have been completed, and the Infirmary at Glasgow, need only be mentioned in proof of our remark. The latter edifice we have often beheld and contemplated with those feelings of admiration, elevated to a kind of rapturous enthusiasm, which the rare union of perfect symmetry and elegant disposition of parts combined with inexpressible beauty and lightness into one whole seldom fails to inspire. We have also seen and admired elegant designs executed by Mr Adam, which were intended for the South Bridge and South Bridge Street of Edinburgh, and if they had been adopted, would have added much to the decoration of that quarter of the town; but being considered unsuitable to the taste or economy of the times, they were rejected.

Strange incongruities appear in buildings which have been erected from designs by Mr Adam. But of these it must be observed, that they have been altered and mutilated in the execution, according to the capricious fancy and vulgar taste of the owners; and it is well known that a slight deviation changes the character and mars the effect of the general design. A lady of rank was furnished by Mr Adam with a design of a house, which, after being executed, he was astonished to find out of all proportion. On inquiring the cause, he was informed that the pediment which he had designed would not admit a piece of rude sculpture which represented the arms of the family, and by the date which it bore incontestably proved its antiquity. It was therefore absolutely necessary to enlarge the dimensions of the pediment, to receive this ancient badge of family honour, and sacrifice the beauty and proportion of the whole building. We have seen a large public edifice which was also designed by Mr Adam; but when it was erected, the length was curtailed of the space of two windows, while the other parts remained according to the original plan. It now presents a heavy unsightly pile, instead of that elegance of proportion and correctness of style which the faithful execution of Mr Adam's design would have probably exhibited.

To the last period of his life, Mr Adam displayed an increasing vigour of genius and refinement of taste; for, in the space of one year preceding his death, he designed eight great public works, besides twenty-five private buildings, so various in their style, and beautiful in their composition, that they have been allowed by the best judges, sufficient of themselves to establish his fame unrivalled as an artist. The present improved taste, which now pretty generally prevails in our public and private edifices, undoubtedly owes much to the elegant and correct style introduced by Mr Adam. His fertile genius was not confined merely to the external decoration of buildings; it displayed itself with equal effect in the internal arrangement and disposition of the apartments, and in the varied, elegant, and beautiful ornaments of chimney pieces and ceilings. But not only did he introduce a total change in the architecture of the country, the manufactures also which are in any way connected with decoration, experienced a considerable degree of improvement by the

exercise of his inventive powers. His talents extended beyond the line of his own profession; he displayed in his numerous drawings in landscape, a luxuriance of composition, and an effect of light and shadow which have rarely been equalled.

He died on the 3d of March 1792, by the bursting of a blood-vessel, in the 64th year of his age, and was buried in Westminster Abbey. His funeral was attended by a select number of friends, some of them of distinguished rank, who esteemed him while living, and who wished to express this last mark of regard. The many elegant buildings, public and private, erected in various parts of the kingdom, from the designs of Mr Adam, will remain lasting monuments of his taste and genius; and the natural suavity of his manners, joined to the excellence of his moral character, secured to him the affectionate regard of his friends, and the esteem of all who enjoyed his acquaintance.

James Adam, whom we have already mentioned as associated with his brother in many of his labours, died on the 20th October 1794.

ADAM's Apple, a name given to a species of CITRUS. See BOTANY Index.

ADAM's Bridge, or *Rama's Bridge*, in *Geography*, a ridge of sands and rocks, extending across the north end of Manara gulf, from the island of that name on the north-west coast of Ceylon, to Ramencote or Ramankoil island, off Raman point.

ADAM's Needle. See YUCCA, BOTANY Index.

ADAM's Peak, a high mountain of the East Indies, in the island of Ceylon, on the top of which it is believed the first man was created. It is in the form of a sugar loaf, and terminates in a circular plain about 200 paces in diameter. The summit is covered with trees, and has a deep lake which supplies the principal rivers of the island. The mountain is seen at the distance of twenty leagues from sea. It is situated in N. Lat. 5. 55. E. Long. 80. 39. See ADAM.

ADAM or ADOM, a town in the Peræa, or on the other side of the Jordan, over against Jericho, where the Jordan began to be dried up on the passage of the Israelites, (Joshua).

ADAMA, or ADMAH, one of the towns that were involved in the destruction of Sodom; (Moses).

ADAMANT, a name sometimes given to the diamond. (See DIAMOND). It is likewise applied to the scoriæ of gold, the magnet, &c.

ADAMARA, in *Geography*, a district of Abyssinia, near the province of Waldubba, containing several considerable villages, that are inhabited by Mahometans; who by their number and strength contribute to the safety of the monks in that part of the country. It is so called from *Adama*, which in the Amharic dialect signifies *pleasant*, the name of an adjacent mountain. The river Anzo runs in a contiguous valley. (*Bruce's Travels*, 4to, vol. iii. p. 179.).

ADAMIC EARTH, a name given to common red clay, alluding to that species of earth of which the first man is supposed to have been made.

ADAMI POMUM, in *Anatomy*, a protuberance in the fore part of the throat, formed by the os hyoides. It is thought to be so called upon a strange conceit, that a piece of the forbidden apple, which Adam ate, stuck by the way and occasioned it.

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ADAMITES, or **ADAMIANS**, in ecclesiastical history, the name of a sect of ancient heretics, supposed to have been a branch of the Basilidians and Carpocratians.

Epiphanius tells us, that they were called Adamites from their pretending to be re-established in the state of innocence, and to be such as Adam was at the moment of his creation, whence they ought to imitate him in his nakedness. They rejected marriage; maintaining, that the conjugal union would never have taken place upon earth had sin been unknown.

This obscure and ridiculous sect did not at first last long; but it was revived, with additional absurdities, in the twelfth century, by one Tandamus, since known by the name of *Tanchelin*, who propagated his errors at Antwerp, in the reign of the emperor Henry V. He maintained, that there ought to be no distinction between priests and laymen, and that fornication and adultery were meritorious actions. Tanchelin had a great number of followers, and was constantly attended by 3000 of these profligates in arms. His sect did not however continue long after his death; but another appeared under the name of *Turlupins*, in Savoy and Dauphiny, where they committed the most brutal actions in open day.

About the beginning of the fifteenth century, one Picard, a native of Flanders, spread these errors in Germany and Bohemia, particularly in the army of the famous Zisca, notwithstanding the severe discipline he maintained. Picard pretended that he was sent into the world as a new Adam, to re-establish the law of nature; and which, according to him, consisted in exposing every part of the body, and having all the women in common. This sect found also some partisans in Poland, Holland, and England: they assembled in the night; and it is asserted, that one of the fundamental maxims of their society was contained in the following verse:

Jura, perjura, secretum prodere noli.

ADAMS, in *Geography*, a township of Berkshire county, in the state of Massachusetts in North America. It is 140 miles north-west of Boston, and contains 2040 inhabitants. In the northern part of this district, a stream called Hudson's brook, has worn a channel through a stratum of white marble, and over the channel the rocks form a fine natural bridge, which is 12 or 15 feet long, 10 feet broad, and more than 60 feet above the water.

ADAMSHIDE, a district of the circle of Rastenburg, belonging to the king of Prussia, which, with Dombrosken, was bought, in 1737, for 42,000 dollars.

ADAMSON, **PATRICK**, a Scottish prelate, archbishop of St Andrew's, was born in the year 1543 in the town of Perth, where he received the rudiments of his education; and afterwards studied philosophy, and took his degree of master of arts at the university of St Andrew's. In the year 1566, he set out for Paris, as tutor to a young gentleman. In the month of June of the same year, Mary queen of Scots being delivered of a son, afterwards James VI. of Scotland and I. of England, Mr Adamson wrote a Latin poem on the occasion. In this poem he gave the prince the title of king of France and England, and this proof of his loyalty involved him in difficulties; for the

French court was offended, and ordered him to be arrested; and he was confined for six months. He was released only through the intercession of Queen Mary, and some of the principal nobility, who interested themselves in his behalf. As soon as he recovered his liberty, he retired with his pupil to Bourges. He was in this city during the massacre at Paris; and the same persecuting spirit prevailing among the Catholics at Bourges as at the metropolis, he lived concealed for seven months in a public house, the master of which, upwards of 70 years of age, was thrown from the top thereof, and had his brains dashed out, for his charity to heretics. Whilst Mr Adamson lay thus in his sepulchre, as he called it, he wrote his Latin poetical version of the book of Job, and his tragedy of Herod in the same language. In the year 1573, he returned to Scotland; and, having entered into holy orders, became minister of Paisley. In the year 1575, he was appointed one of the commissioners, by the general assembly, to settle the jurisdiction and policy of the church; and the following year he was named, with Mr David Lindsay, to report their proceedings to the earl of Morton, then regent. About this time the earl appointed him one of his chaplains; and, on the death of Bishop Douglas, promoted him to the archiepiscopal see of St Andrew's, a dignity which brought upon him great trouble and uneasiness: for now the clamour of the Presbyterian party rose very high against him, and many inconsistent absurd stories were propagated concerning him. Soon after his promotion, he published his catechism in Latin verse, a work highly approved even by his enemies; but, nevertheless, they still continued to persecute him with great violence. In 1578, he submitted himself to the general assembly, which procured him peace but for a very little time; for the year following, fresh accusations were brought against him. In the year 1582, being attacked with a grievous disease, in which the physicians could give him no relief, he happened to take a simple medicine from an old woman, which did him service. The woman, whose name was Alison Pearson, was thereupon charged with witchcraft, and committed to prison, but escaped out of her confinement; however, about four years afterwards, she was again found and burnt for a witch. In 1583, King James came to St Andrew's; and the archbishop, being much recovered, preached before him, and disputed with Mr Andrew Melvil, in presence of his majesty, with great reputation; which drew upon him fresh calumny and persecution. The king, however, was so well pleased with him, that he sent him ambassador to Queen Elizabeth, at whose court he resided for some years. His conduct, during his embassy, has been variously reported by different authors. Two things he principally laboured, viz. the recommending the king his master to the nobility and gentry of England, and the procuring some support for the episcopal party in Scotland. His eloquent preaching drew after him such crowds of people, and raised in their minds such a high idea of the young king his master, that Queen Elizabeth forbade him to enter the pulpit during his stay in her dominions. In 1584, he was recalled, and sat in the parliament held in August at Edinburgh. The Presbyterian party was still very violent against the archbishop. A provincial synod was held at St Andrew's in April 1586: the arch-

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bishop was here accused and excommunicated: he appealed to the king and the states, but this availed him little; for the mob being excited against him, he durst scarcely appear in public. At the next general assembly, a paper being produced, containing the archbishop's submission, he was absolved from the excommunication. In 1588, fresh accusations were brought against him. The year following he published the *Lamentations of the prophet Jeremiah in Latin verse*; which he dedicated to the king, complaining of his hard usage. In the latter end of the same year, he published a translation of the *Apocalypse in Latin verse*; and a copy of Latin verses, addressed also to his majesty, deploring his distress. The king, however, was not moved by his application; for the revenue of his see was granted to the duke of Lennox; so that the prelate and his family were literally reduced to the want of bread. During the remaining part of his unfortunate life he was supported by charitable contribution, and he died in 1591. The character of this prelate has been variously represented, according to the sentiments of religion and politics which prevailed. But there is little doubt that he encouraged and supported, under the authority of the king, oppressive and injurious measures. Bigotted and timid, he wanted that firmness and intrepidity, which promise steadiness and uniformity of conduct in the conspicuous characters of turbulent times. His learning was unquestioned; and he acquired great reputation as a popular preacher. In his adversity he submitted with pious resignation to his hard fate. The panegyric of the editor of his works, Mr Wilson, is extravagant and absurd. He says, that "he was a miracle of nature, and rather seemed to be the immediate production of God Almighty, than born of a woman."

ADAMUS. The philosopher's stone is so called by alchemists; they say it is an animal, and that it has carried its invisible *Eve* in its body, since the moment they were united by the Creator.

ADANA, in *Geography*, a town of Asia Minor, in Natolia, and in the province of Caramania. It is situated on the river Choquen; on the banks of which stands a small but strong castle built on a rock. It has a great number of beautiful fountains brought from the river by means of water-works. Over the river there is a stately bridge of fifteen arches, which leads to the water-works. The climate is pleasant and healthy, and the winter mild and serene: but the summer is so hot as to oblige the principal inhabitants to retire to the neighbouring mountains, where they spend six months among shady trees and grottoes, in a most delicious manner. The adjacent country is rich and fertile, and produces melons, cucumbers, pomegranates, pulse, and herbs of all sorts, all the year round; besides corn, wine, and fruits in their proper season. It is 30 miles north-east of Tarsus, on the road to Aleppo. E. Long. 36. 12. N. Lat. 38. 10.

ADANSON, MICHAEL, a celebrated naturalist, was born at Aix in Provence in the year 1727. He was sent to Paris in early life, and devoted his studies with great assiduity to medicine, botany, and astronomy, and was a pupil of the celebrated Reaumur. He went to Senegal in the year 1748, where he remained six years examining the natural productions of that country. He presented the fruits of his discove-

ries in geography and natural history to the Royal Academy; and in consequence of these communications he was appointed one of their corresponding members. In the year 1759, on the death of Reaumur he was elected a member in his place; and about the same time he was admitted an honorary member of the Royal Society of London. Having spent six years in Senegal, he returned to Paris, where he published a work entitled *Histoire Naturelle du Senegal*, in 4to; and in 1763 his *Familles des Plantes*, 2 vols 8vo. In the year 1775 he presented to the academy the plan of a natural history, which he did not live to execute. He died on the 3d of August 1806. See ADANSON, M. SUPPLEMENT.

ADANSONIA, ETHIOPIAN SOUR-GOURD, MONKEYS-BREAD, or AFRICAN CALABASH-TREE. See BOTANY Index.

ADAR, the name of a Hebrew month, answering to the end of February and beginning of March, the 12th of their sacred, and 6th of their civil year. On the 7th day of it, the Jews keep a fast for the death of Moses; on the 13th, they have the feast of Esther: and on the 14th, they celebrate the feast of Purim, for their deliverance from Haman's conspiracy. As the lunar year which the Jews followed in their calculations, is shorter than the solar by about 11 days, which at the end of three years make a month, they then intercalate a 13th month, which they call *Veadar*, or the second *Adar*.

ADARCE, a kind of concreted salts found on reeds and other vegetables, and applied by the ancients as a remedy in several cutaneous diseases.

ADARCON, in Jewish antiquity, a gold coin mentioned in Scripture, worth about 15s. sterling.

ADARME, in *Commerce*, a small weight in Spain, which is also used at Buenos Ayres, and in all Spanish America. It is the 16th part of an ounce, which at Paris is called the *demi-gros*. But the Spanish ounce is seven per cent. lighter than that of Paris. Stephens renders it in English by a *drachm*.

ADATAIS, **ADATSI**, or **ADATYS**, in *Commerce*, a muslin or cotton cloth, very fine and clear, of which the piece is ten French ells long, and three quarters broad. It comes from the East Indies; and the finest is made in Bengal.

ADCORDABILIS DENARIJ, in old law books, signify money paid by the vassal to his lord, upon the selling or exchanging of a feud.

ADCRESCENTES, among the Romans, denoted a kind of soldiery, entered in the army, but not yet put on duty; from these the standing forces were recruited. See ACCENSI.

ADDA, in *Geography*, a river of Switzerland and Italy, which rises in Mount Branlio, in the country of the Grisons, and, passing through the Valteline, traverses the lake Como and the Milanese, and falls into the Po, near Cremona.

ADDEPHAGIA, in *Medicine*, a term used by some physicians, for gluttony, or a voracious appetite.

ADDER, in *Zoology*, a name for the VIPER. See COLUBER.

ADDER-BOLTS, or **ADDER-FLIES**. See LIBELLULA.

Sea ADDER, the English name for a species of SYNGNATHUS.

Water ADDER, a name given to the COLUBER *Natrix*.
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ADDER-stung, is used in respect of cattle, when stung by any kind of poisonous reptiles, as adders, scorpions, &c. or bit by a hedgehog or shrew.—For the cure of such bites, some use an ointment made of dragon's blood, with a little barley meal, and the whites of eggs.

ADDER-wort, or *Snakeweed*. See POLYGONUM.

ADDEXTRATORES, in the court of Rome, the pope's mitre-bearers, so called according to Ducange, because they walk at the pope's right hand when he rides to visit the churches.

ADDICE, or **ADZE**, a kind of crooked axe used by shipwrights, carpenters, coopers, &c.

ADDICTI, in antiquity, a kind of slaves, among the Romans, adjudged to serve some creditor whom they could not otherwise satisfy, and whose slaves they became till they could pay or work out the debt.

ADDICTION, among the Romans, was the making over goods to another, either by sale or by legal sentence; the goods so delivered were called *bona addicta*. Debtors were sometimes delivered over in the same manner; and thence called *servi addicti*.

ADDICTIO IN DIEM, among the Romans, the adjudging a thing to a person for a certain price, unless by such a day the owner, or some other, give more for it.

ADDISON, LANCELOT, son of Lancelot Addison a clergyman, was born in the parish of Crosby-Ravensworth in Westmoreland, in the year 1632. He was educated at Queen's College, Oxford; and at the restoration of King Charles II. accepted of the chaplainship of the garrison of Dunkirk: but that fortress being delivered up to the French in 1662, he returned to England, and was soon after made chaplain to the garrison of Tangier; where he continued seven years, and was greatly esteemed. In 1670, he returned to England, and was made chaplain in ordinary to the king; but his chaplainship of Tangier being taken from him on account of his absence, he found himself straitened in his circumstances, when he seasonably obtained the rectory of Milston in Wiltshire, worth about 120*l.* per annum. He afterwards became a prebendary of Sarum; took his degree of doctor of divinity at Oxford; and in 1683 was made dean of Litchfield, and the next year archdeacon of Coventry. His life was exemplary; his conversation pleasing, and greatly instructive; and his behaviour as a gentleman, a clergyman, and a neighbour, did honour to the place of his residence. He wrote, 1. A Short Narrative of the Revolutions of the Kingdoms of Fex and Morocco: 2. The present history of the Jews: 3. A Discourse on Catechising: 4. A Modest Plea for the Clergy: 5. An Introduction to the Sacrament: 6. The first State of Mahometism: and several other pieces. This worthy divine died on the 20th of April 1703, and left three sons: Joseph, the subject of the next article; Gulston, who died while governor of Fort St George; Lancelot, master of arts, and fellow of Magdalen college in Oxford: and one daughter, first married to Dr Sarte, prebendary of Westminster, and afterwards to Daniel Combes, Esq.

ADDISON, *Joseph*, the son of the preceding Dean Addison, was born at Milston, near Ambresbury, in Wiltshire, on the 11th of May 1672; and not being thought likely to live, was baptized the same day. He

received the first rudiments of his education at the place of his nativity under the reverend Mr Naish; but was soon removed to Salisbury under the care of Mr Taylor; and from thence to the Charter-house, where his acquaintance with Sir Richard Steele commenced. About the age of fifteen, he was entered at Queen's college, Oxford, where he applied very closely to the study of classical learning, in which he made a surprising proficiency.

In the year 1687, Dr Lancaster, dean of Magdalen college, having by chance seen a Latin poem of Mr Addison's, was so pleased with it, that he immediately got him elected into that house, where he took up his degrees of bachelor and master of arts. His Latin pieces in the course of a few years, were exceedingly admired in both universities; nor were they less esteemed abroad, particularly by the celebrated Boileau, who is reported to have said, that he would not have written against Perrault, had he before seen such excellent pieces by a modern hand. He published nothing in English before the twenty-second year of his age; when there appeared a short copy of verses written by him, and addressed to Mr Dryden, which procured him great reputation from the best judges. This was soon followed by a translation of the Fourth Georgic of Virgil, (omitting the story of Aristæus), much commended by Mr Dryden. He wrote also the Essay on the Georgics, prefixed to Mr Dryden's translation. There are several other pieces written by him about this time; amongst the rest, one dated the third of April 1694, addressed to H. S. that is, Dr Sacheverel, who became afterwards so famous, and with whom Mr Addison lived once in the greatest friendship; but their intimacy was some time after broken off by their disagreement in political principles. In the year 1695 he wrote a poem to King William on one of his campaigns, addressed to Sir John Somers, lord-keeper of the great seal. This gentleman received it with great pleasure, took the author into the number of his friends, and bestowed on him many marks of his favour.

Mr Addison had been closely pressed, while at the university, to enter into holy orders; and had once resolved upon it: but his great modesty, his natural diffidence, and an uncommonly delicate sense of the importance of the sacred function, made him afterwards alter his resolution; and having expressed an inclination to travel, he was encouraged thereto by his patron above-mentioned, who by his interest procured him from the crown a pension of 300*l.* per annum to support him in his travels. He accordingly made a tour to Italy in the year 1699; and in 1701, he wrote a poetical epistle from Italy to the earl of Halifax, which has been universally esteemed as a most excellent performance. It was translated into Italian verse by the abbot Antonio Maria Salvini, Greek professor at Florence. In the year 1705, he published an account of his travels, dedicated to Lord Somers; which, though at first but indifferently received, yet in a little time met with its deserved applause.

In the year 1702, he was about to return to England, when he received advice of his being appointed to attend Prince Eugene, who then commanded for the emperor in Italy; but the death of King William happening soon after, put an end to this affair as well as his pension; and he remained for a considerable time unemployed.

Addison.

employed. But an unexpected incident at once raised him, and gave him an opportunity of exerting his fine talents to advantage: for in the year 1704, the lord treasurer Godolphin happened to complain to Lord Halifax, that the duke of Marlborough's victory at Blenheim had not been celebrated in verse in the manner it deserved; and intimated, that he would take it kindly if his lordship, who was the known patron of the poets, would name a gentleman capable of doing justice to so elevated a subject. Lord Halifax replied, somewhat hastily, that he did know such a person, but would not mention him; adding, that long had he seen with indignation, men of no merit maintained in luxury at the public expence, whilst those of real worth and modesty were suffered to languish in obscurity. The treasurer answered very coolly, that he was sorry there should be occasion for such an observation, but that he would do his endeavour to wipe off such reproaches for the future; and he engaged his honour, that whoever his lordship named, as a person capable of celebrating this victory, should meet with a suitable recompense. Lord Halifax thereupon named Mr Addison; insisting, however, that the treasurer himself should send to him; which he promised. Accordingly he prevailed on Mr Boyle (afterwards Lord Carlton) then chancellor of the exchequer, to make the proposal to Mr Addison; which he did in so polite a manner, that our author readily undertook the task. The lord-treasurer had a sight of the piece, when it was carried no farther than the celebrated simile of the angel; and was so pleased with it, that he immediately appointed Mr Addison a commissioner of appeals, vacant by the promotion of Mr Locke, chosen one of the lords commissioners for trade. The Campaign is addressed to the duke of Marlborough; it gives a short view of the military transactions in 1704, and contains a noble description of the two great actions at Schellemburg and Blenheim. In 1705, he attended Lord Halifax to Hanover; and the ensuing year was appointed under secretary to Sir Charles Hedges secretary of state; in which office he acquitted himself so well, that the earl of Sunderland, who succeeded Sir Charles in December, continued Mr Addison in his employment.

A taste for operas beginning at this time to prevail in England, and many persons having solicited Mr Addison to write one, he complied with their request, and composed his *Rosamond*. This, however, whether from the defect of the music, or from the prejudices in favour of the Italian taste, did not succeed upon the stage; but the poetry of it has been, and always will be justly admired. About this time, Sir Richard Steele composed his comedy of the *Tender Husband*, to which Mr Addison wrote a prologue. Sir Richard surprised him with a dedication of this play, and acquainted the public, that he was indebted to him for some of the most excellent strokes in the performance. The marquis of Wharton, being appointed lord lieutenant of Ireland in 1709, took Mr Addison with him as his secretary. Her Majesty also made him keeper of the records of Ireland, and as a farther mark of her favour, considerably augmented the salary annexed to that place. Whilst he was in this kingdom, the *Tatler* was first published; and he discovered his friend Sir Richard Steele to be the author, by an observation on *Virgil*, which he had communicated to him. He

afterwards assisted considerably in carrying on this paper, which the author acknowledges. The *Tatler* being laid down, the *Spectator* was set on foot, and Mr Addison furnished great part of the most admired papers. The *Spectator* made its first appearance in March 1711, and was brought to a conclusion in September 1712.

His celebrated *Cato* appeared in 1713. He formed the design of a tragedy upon this subject when he was very young, and wrote it when on his travels; he retouched it in England, without any intention of bringing it on the stage; but his friends being persuaded it would serve the cause of liberty, he was prevailed on by their solicitations, and it was accordingly exhibited on the theatre, with a prologue by Mr Pope, and an epilogue by Dr Garth. It was received with the most uncommon applause, having run thirty-five nights without interruption. The Whigs applauded every line in which liberty was mentioned, as a satire on the Tories; and the Tories echoed every clap, to shew that the satire was unfelt. When it was printed, notice was given that the queen would be pleased if it was dedicated to her; but as he had designed that compliment elsewhere, he found himself obliged, "says Tickell," by his duty on the one hand, and his honour on the other, to send it into the world without any dedication." It was no less esteemed abroad, having been translated into French, Italian, and German; and it was acted at Leghorn, and several other places, with vast applause. The Jesuits of St Omers made a Latin version of it, and the students acted it with great magnificence.

About this time another paper called the *Guardian*, was published by Steele, to which Addison was a principal contributor. It was a continuation of the *Spectator*, and was distinguished by the same elegance and the same variety; but, in consequence of Steele's propensity to politics, was abruptly discontinued in order to write the *Englishman*.

The papers of Addison are marked in the *Spectator* by one of the letters in the name of *Clio*, and in the *Guardian* by a *Hand*. Many of these papers were written with powers truly comic, with nice discrimination of characters, and accurate observation of natural or accidental deviations from propriety: but it was not supposed that he had tried a comedy on the stage, till Steele, after his death, declared him the author of "*The Drummer*." This, however, he did not know to be true by any cogent testimony: for when Addison put the play into his hands, he only told him it was the work of a gentleman in the company; when it was received, as is confessed, with cold disapprobation, he was probably less willing to claim it. Tickell omitted it in his collection; but the testimony of Steele, and the total silence of any other claimant, has determined the public to assign it to Addison, and it is now printed with his other poetry. Steele carried "*the Drummer*" to the playhouse, and afterwards to the press, and sold the copy for 50 guineas. To Steele's opinion may be added the proof supplied by the play itself, of which the characters are such as Addison would have delineated, and the tendency such as Addison would have promoted.

It is said that Mr Addison intended to have composed an English dictionary upon the plan of the Italian (Della

Addison

Addison.

(Della Crusea); but, upon the death of the queen, being appointed secretary to the lords justices, he had not leisure to carry on such a work. When the earl of Sunderland was appointed lord lieutenant of Ireland, Mr Addison was again made secretary for the affairs of that kingdom: and, upon the earl's being removed from the lieutenancy, he was chosen one of the lords of trade.

Not long afterwards an attempt was made to revive the *Spectator*, at a time indeed by no means favourable to literature, when the accession of a new family to the throne filled the nation with anxiety, discord, and confusion; and either the turbulence of the times or the satiety of the readers put a stop to the publication, after an experiment of 80 numbers, which were afterwards collected into an eighth volume, perhaps more valuable than any of those that went before it: Addison produced more than a fourth part.

In 1715, he began the *Freeholder*, a political paper, which was much admired, and proved of great use at that juncture. He published also, about this time, verses to Sir Godfrey Kneller upon the king's picture, and some to the princess of Wales with the tragedy of *Cato*.

Before the arrival of King George he was made secretary to the regency, and was required by his office to send notice to Hanover that the queen was dead, and that the throne was vacant. To do this would not have been difficult to any man but Addison, who was so overwhelmed with the greatness of the event, and so distracted by choice of expression, that the lords, who could not wait for the niceties of criticism, called Mr Southwell, a clerk in the house, and ordered him to despatch the message. Southwell readily told what was necessary, in the common style of business, and valued himself upon having done what was too hard for Addison.

In 1716, he married the countess dowager of Warwick, whom he had solicited by a very long and anxious courtship. He is said to have first known her by becoming tutor to her son. The marriage, if uncontradicted report can be credited, made no addition to his happiness; it neither found them nor made them equal. She always remembered her own rank, and thought herself entitled to treat with very little ceremony the tutor of her son. It is certain that Addison has left behind him no encouragement for ambitious love. The year after, 1717, he rose to his highest elevation, being made secretary of state; but is represented as having proved unequal to the duties of his place. In the house of commons he could not speak, and therefore was useless to the defence of the government. In the office he could not issue an order without losing his time in quest of fine expressions. At last, finding by experience his own inability for public business, he was forced to solicit his dismissal, with a pension of 1500*l.* a year. Such was the account of those who were inclined to detract from his abilities; but by others his relinquishment was attributed to declining health, and the necessity of recess and quiet.

In his retirement, he applied himself to a religious work*, which he had begun long before; part of which, scarce finished, has been printed in his works. He intended also to have given an English paraphrase of some of David's psalms. But his ailments increased,

and cut short his designs. He had for some time been oppressed by an asthmatic disorder, which was now aggravated by a dropsy, and he prepared to die conformably to his precepts and professions. He sent, as Pope relates, a message by the earl of Warwick to Mr Gay, desiring to see him: Gay, who had not visited him for some time before, obeyed the summons, and found himself received with great kindness. The purpose for which the interview had been solicited was then discovered: Addison told him, that he had injured him; but that, if he recovered, he would recompense him. What the injury was he did not explain, nor did Gay ever know: but supposed that some preferment designed for him had by Addison's intervention been withheld.—Another deathbed interview, of a more solemn nature, is recorded: Lord Warwick was a young man of very irregular life, and perhaps of loose opinions. Addison, for whom he did not want respect, had very diligently endeavoured to reclaim him; but his arguments and expostulations had no effect: One experiment, however, remained to be tried. When he found his life near its end, he directed the young lord to be called: and when he desired, with great tenderness, to hear his last injunctions, told him, "I have sent for you that you may see how a Christian can die." What effect this awful scene had on the earl's behaviour is not known: he died himself in a short time. Having given directions to Mr Tickell for the publication of his works, and dedicated them on his deathbed to his friend Mr Craggs, he died June 17. 1719, at Holland-house, leaving only one child, a daughter, by his marriage.

Addison's course of life before his marriage has been detailed by Pope. He had in the house with him Budgell, and perhaps Philips. His chief companions were Steele, Budgell, Philips, Carey, Davenant, and Colonel Brett. With one or other of these he always breakfasted. He studied all morning; then dined at a tavern, and went afterwards to Button's. From the coffeehouse he went again to the tavern, where he often sat late and drank too much wine.

Dr Johnson, in delineating the character of Addison, observes with Tickell, that he employed wit on the side of virtue and religion. He not only made the proper use of wit himself, but taught it to others; and from his time it has been generally subservient to the cause of reason and truth. He has dissipated the prejudice that had long connected gaiety with vice, and easiness of manners with laxity of principles. He has restored virtue to its dignity, and taught innocence not to be ashamed. This is an elevation of literary character, "above all Greek, above all Roman fame," No greater felicity can genius attain than that of having purified intellectual pleasure, separated mirth from indecency, and wit from licentiousness; of having taught a succession of writers to bring elegance and gaiety to the aid of goodness; and, to use expressions yet more awful, of having "turned many to righteousness." As a describer of life and manners, he must be allowed to stand perhaps the first of the first rank. His humour, which as Steele observes, is peculiar to himself, is so happily diffused as to give the grace of novelty to domestic scenes and daily occurrences. He never "outsteps the modesty of nature," nor raises merriment or wonder by the violation of truth.

Addison.

Evidences
the
Christian
igion.

Addison.

truth. His figures neither divert by distortion, nor amaze by aggravation. He copies life with so much fidelity, that he can hardly be said to invent; yet his exhibitions have an air so much original, that it is difficult to suppose them not merely the product of imagination. As a teacher of wisdom he may be confidently followed. His religion has nothing in it enthusiastic or superstitious; he appears neither weakly credulous nor wantonly sceptical; his morality is neither dangerously lax nor impracticably rigid. All the enchantment of fancy and all the cogency of argument are employed to recommend to the reader his real interest, the care of pleasing the Author of his being. Truth is shown sometimes as the phantom of a vision, sometimes appears half-veiled in an allegory; sometimes attracts regard in the robes of fancy, and sometimes steps forth in the confidence of reason. She wears a thousand dresses, and in all is pleasing.

The doctor, however, has related the following anecdote, which every admirer of Addison, every man of feeling, must be reluctant to believe. "Steele (says the doctor), whose imprudence of generosity, or vanity of profusion, kept him always incurably necessitous, upon some pressing exigence, in an evil hour, borrowed a hundred pounds of his friend, probably without much purpose of repayment; but Addison, who seems to have had other notions of a hundred pounds, grew impatient of delay, and reclaimed his loan by an execution. Steele felt, with great sensibility, the obduracy of his creditor; but with emotions of sorrow rather than of anger." It is much to be wished, says Dr Kippis, that Dr Johnson had produced his authority for this narration. It is very possible, that it may be only a story the doctor had somewhere heard in conversation, and which is entirely groundless: "and this I am the rather inclined to believe, as I have been assured, by one of the most respectable characters in the kingdom, that the fact hath no foundation in truth." Mr Potter, in a late publication, hath informed us, that he is told by the best authority that the story is an absolute falsehood.

Mr Tyers, in "A historical Essay on Mr Addison," printed, but not published, has mentioned some facts concerning him, with which we were not before acquainted. These are, That he was laid out for dead as soon as he was born: that, when he addressed his verses on the English poets to Henry Sacheverell, he courted that gentleman's sister; that, whenever Jacob Tonson came to him for the Spectator, Bayle's French Historical and Critical Dictionary lay always open before him: that, upon his return to England, after his travels, he discharged some old debts he had contracted at Oxford, with the generosity of good interest: that he was put into plentiful circumstances by the death of a brother in the East Indies: that, having received encouragement from a married lady, of whom he had been formerly enamoured, he had the integrity to resist the temptation: that he refused a gratification of a three hundred pounds bank-note, and afterwards of a diamond-ring of the same value, from a Major Dunbar, whom he had endeavoured to serve in Ireland by his interest with Lord Sunderland: and that his daughter by Lady Warwick died a few years ago unmarried, residing at Bilton near Rugby, and

possessing an income of more than twelve hundred a-year.

The following letter, which probably relates to the case of Major Dunbar, reflects great honour on Mr Addison's integrity. "June 26. 1715,—SIR, I find there is a very strong opposition formed against you; but I shall wait on my lord lieutenant this morning, and lay your case before him as advantageously as I can, if he is not engaged in other company. I am afraid what you say of his grace does not portend you any good. And now, Sir, believe me, when I assure you I never did, nor ever will, on any pretence whatsoever, take more than the stated and customary fees of my office. I might keep the contrary practice concealed from the world, were I capable of it, but I could not from myself; and I hope I shall always fear the reproaches of my own heart more than those of all mankind. In the mean time, if I can serve a gentleman of merit, and such a character as you bear in the world, the satisfaction I meet with on such an occasion is always a sufficient, and the only reward to, Sir, your most obedient, humble servant, J. ADDISON."—The anecdote which follows was told by the late Dr Birch. Addison and Mr Temple Stanyan were very intimate. In the familiar conversations which passed between them, they were accustomed freely to dispute each other's opinions. Upon some occasion, Mr Addison lent Stanyan five hundred pounds. After this, Mr Stanyan behaved with a timid reserve, deference, and respect; not conversing with the same freedom as formerly, or canvassing his friend's sentiments. This gave great uneasiness to Mr Addison. One day they happened to fall upon a subject, on which Mr Stanyan had always been used strenuously to oppose his opinion. But, even upon this occasion, he gave way to what his friend advanced, without interposing his own view of the matter. This hurt Mr Addison so much, that he said to Mr Stanyan, "Either contradict me, or pay me the money."

In Tickell's edition of Mr Addison's works there are several pieces hitherto unmentioned, viz. The Dissertation on Medals; which, though not published till after his death, yet he had collected the materials, and began to put them in order, at Vienna, in 1702. A pamphlet, entitled, The present State of the War, and the Necessity of an Augmentation, considered. The late Trial and Conviction of Count Tariff. The Whig Examiner came out on the 14th of September 1716; there were five of these papers attributed to Mr Addison, and they are the severest pieces he ever wrote. He is said also to have been the author of a performance entitled *Dissertatio de insignioribus Romanorum Poetis*, and of a Discourse on Ancient and Modern Learning.

ADDITAMENT, something added to another. Thus physicians call the ingredients added to a medicine already compounded, *additaments*.

ADDITION, is the joining together or uniting two or more things, or augmenting a thing by the accession of others thereto.

ADDITION, in *Arithmetic, Algebra, &c.* See these articles.

ADDITION, in *Music*, a dot marked on the right side of a note, signifying that it is to be founded or lengthened

Addison

Addition.

Addition
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Adel.

ened half as much more as it would have been without such mark.

ADDITION, in *Law*, is that name or title which is given to a man over and above his proper name and surname, to show of what estate, degree, or mystery he is; and of what town, village, or country.

ADDITIONS of Estate, or Quality, are, Yeoman, Gentleman, Esquire, and such like.

ADDITIONS of Degree, are those we call names of dignity; as Knight, Lord, Earl, Marquis, and Duke.

ADDITIONS of Mystery, are such as Scrivener, Painter, Mason, and the like.

ADDITIONS of Place, are, of Thorp, of Dale, of Woodstock.—Where a man hath household in two places, he shall be said to dwell in both; so that his addition in either may suffice. Knave was anciently a regular addition. By stat. 1. Hen. V. cap. 5. it was ordained, that in such suits or actions where process of outlawry lies, such addition should be made to the name of the defendant, to show his state, mystery, and place where he dwells; and that the writs not having such additions should abate if the defendant take exception thereto; but not by the office of the court. The reason of this ordinance was, that one man might not be troubled by the outlawry of another; but by reason of the certain addition, every person might bear his own burden.

ADDITIONS, in distilling, a name given to such things as are added to the wash, or liquor, while in a state of fermentation, in order to improve the vinosity of the spirit, procure a larger quantity of it, or give it a particular flavour. All things, of whatever kind, thus added in the time of fermentation, are called by those of the business who speak most intelligently *additions*; but many confound them with things of a very different nature, under the name of *ferments*. See **DISTILLING**.

ADDITIONS, in *Heraldry*, some things added to a coat-of-arms, as marks of honour; and therefore directly opposite to abatements. Among additions we reckon **BORDURE**, **QUARTER**, **CANTON**, **GYRON**, **PILE**, &c. See these articles.

ADDRESS, in a general sense, is used for skill and good management, and of late has been adopted from the French. It is used also in commerce, as synonymous with direction to a person or place. The word is formed of the French verb, *addresser*, *To direct any thing to a person*.

ADDUCENT MUSCLES, or **ADDUCTORS**, in *Anatomy*, those muscles which pull one part of the body towards another. See **ANATOMY**, *Table of the Muscles*.

ADEB, in *Commerce*, the name of a large Egyptian weight, used principally for rice, and consisting of 210 okes, each of three rotolos, a weight of about two drams less than an English pound. But this is no certain weight; for at Rosetto the adeb is only 150 okes.

ADEL, a kingdom on the eastern coast of Africa, which reaches as far as the straits of Babelmandel, which unite the Red sea to the sea of Arabia. This country produces corn, and feeds a great number of cattle. The inhabitants carry on a trade in gold, silver, ivory, oil, frankincense, a sort of pepper, and other merchandises of Arabia and the Indies. The king was formerly a vassal to the grand negus of Abyssinia: but being Mahometans, and the Abyssinians a sort of Chri-

stians, they could not agree; and in 1535 came to an open rupture, when the Adeliens threw off the yoke, seeking protection from the Grand Signior. The principal places are, Adela, seated in the centre of the country, and the town where the king resides. It rains very seldom in this country.

ADELIA. See **BOTANY Index**.

ADELME, or **ALDHELM**, son to Kenred, nephew to Ina king of the West Saxons, after having been educated abroad, was abbot of Malmesbury 30 years. He was the first Englishman who wrote in Latin, the first who brought poetry into England, and the first bishop of Sherburn. He lived in great esteem till his death, which happened in 709. He was canonized, and many miracles were ascribed to him. He is mentioned with great honour by Camden and Bayle, and his life was written by William of Malmesbury.

ADELPHIANI, in church history, a sect of ancient heretics, who fasted always on Sundays.

ADELSCALC, in ancient customs, denotes a servant of the king. The word is also written *adelscalche*, and *adelscalus*. It is compounded of the German *adel*, or *edel*, "noble," and *scal*, "servant." Among the Bavarians, *adelscales* appear to have been the same with royal *thanes* among the Saxons, and those called *ministri regis* in ancient charters.

ADELUNG, J. C. a celebrated German grammarian. See **SUPPLEMENT**.

ADEPTION, in the *Civil Law*, implies the revocation of a grant, donation, or the like.

ADEN, formerly a rich and considerable town of Arabia the Happy. It is seated by the sea side, a little eastward of the straits of Babelmandel. N. Lat. 12. 40. E. Long. 46. 13.

ADENANTHERA, **BASTARD FLOWER-FENCE**. See **BOTANY Index**.

ADENBURG, or **ALDENBURG**, a town of Westphalia, and in the duchy of Berg, subject to the Elector Palatine. It is 12 miles north-east of Cologne, and 17 west of Bonn. E. Long. 7. 25. N. Lat. 51. 2.

ADENIA. See **BOTANY Index**.

ADENOGRAPHY, that part of anatomy which treats of the glandular parts. See **ANATOMY**.

ADENOIDES, glandulous, or of a glandular form; an epithet applied to the **PROSTATE**.

ADENOLOGY, the same with **ADENOGRAPHY**.

ADENOS, a kind of cotton; otherwise called *marine cotton*. It comes from Aleppo by the way of Marseilles, where it pays 20 per cent. duty.

ADEONA, in mythology, the name of a goddess invoked by the Romans when they set out upon a journey.

ADEPHAGIA, in mythology, the goddess of gluttony, to whom the Sicilians paid religious worship.

ADEPS, in *Anatomy*, the fat found in the abdomen. It also signifies animal fat of any kind.

ADEPTS, a term among alchemists for those who pretended to have found the panacea and philosophers stone. "Such is the nature, says Paracelsus, of this higher philosophy, that one mortal can no more communicate it to another, than the paper on which letters are traced can of itself declare their meaning. It originates not from man, but from heaven."

ADERBIJAN. See **ADIRBEITSAN**.

ADERNO, a small place in the Val di Demona in the

Adel
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Aderno.

Aderno
||
Adhoa.

the kingdom of Sicily. E. Long. 15. 25. N. Lat. 38. 5. Anciently *ADRANUM*, at the foot of Mount Gibel. The ruined walls of this ancient city still exhibit an air of its former grandeur.

ADES, or *HADES*, denotes the invisible state. In the heathen mythology, it comprehends all those regions that lie beyond the river Styx, viz. Erebus, Tartarus, and Elysium. See *HELL*.

ADESSENARIANS, *ADESSENARI*, in church history, a sect of Christians who hold the real presence of Christ's body in the eucharist, though not by way of transubstantiation. They differ considerably as to this presence; some holding that the body of Christ is in the bread; others, that it is about the bread; and others that it is under the bread.

ADFILIATION, a Gothic custom, whereby the children of a former marriage are put upon the same footing with those of the second. This is also called *unio prolium*, and still retained in some parts of Germany, though Heineccius observes that this is not adoption.

AD FINES, (Antonine), a town of Switzerland, supposed to be the modern *Pfin*, in the north of the district of Turgow, on the rivelet Thur, not far from the borders of Suabia, about half way between Constance and Frauenfeld. So called, because when Cicerina, general of the emperor Vitellius, with the auxiliary Rhetians, defeated the Helvetii, the former extended their borders thus far, their territory ending here; and in the time of the Romans, it was the last town in this quarter, and of some repute.

ADHA, a festival which the Mahometans celebrate on the 10th day of the month *Dhoulhegiat*, which is the 12th and last of their year. This month being particularly destined for the ceremonies which the pilgrims observe at Mecca, it takes its name from thence, for the word signifies *the month of Pilgrimage*. On that day they sacrifice with great solemnity, at Mecca, and nowhere else, a sheep, which is called by the same name as the festival itself. The Turks commonly call the festival the *Great Bairam*, to distinguish it from the lesser, which ends their fast, and which the Christians of the Levant call the *Easter of the Turks*. The Mahometans celebrate this festival, out of the city of Mecca, in a neighbouring valley; and sometimes they sacrifice there a camel. See *BAIRAM*.

ADHATODA, in *Botany*. See *JUSTICIA*, *BOTANY Index*.

ACTION of ADHERENCE, in *Scots Law*; an action competent to a husband or wife, to compel either party to adhere, in case of desertion.

ADHESION, in a general sense, implies the sticking or adhering of bodies together.

ADHESION, in *Philosophy*. See *COHESION* in this work, and *ADHESION* in the *SUPPLEMENT*.

ADHESION, in *Anatomy*, a term for one part sticking to another, which in a natural state are separate. For the most part, if any of those parts in the thorax or belly lie in contact, and inflame, they grow together.

ADHIL, in *Astronomy*, a star of the sixth magnitude, upon the garment of Andromeda, under the last star in her foot.

ADHOA, in ancient customs, denotes what we otherwise call *relief*. In which sense we sometimes also

find the word written *adoha*, *adhoamentum*, and *adhogamentum*.

ADIANUM, *MAIDEN-HAIR*; in *Botany*. See *BOTANY Index*.

ADIAPHORISTS, in church history, a name importing lukewarmness, given, in the 16th century, to the moderate Lutherans, who embraced the opinion of Melancthon, whose disposition was much more pacific than that of Luther.

ADJAZZO, *ADRAZZO*, or *AJACCIO*, in *Geography*, a handsome town and castle of Corsica in the Mediterranean, with a bishop's see, and a good harbour. It is populous and fertile in wine. It is 27 miles south-west of Corte. E. Long. 41. 54. N. Lat. 38. 5.

ADJECTIVE, in *Grammar*, a kind of noun joined with a substantive, either expressed or implied, to denote its qualities or incidents. See *GRAMMAR*.

ADIGE, a river in Italy, which taking its rise south of the lake Glacc among the Alps, runs south by Trent, then east by Verona in the territory of Venice, and falls into the gulf of Venice, north of the mouth of the Po.

ADJOURNMENT, the putting off a court or other meeting, till another day. There is a difference between the adjournment and the prorogation of the parliament; the former not only being for a shorter time, but also done by the house itself; whereas the latter is an act of royal authority.

ADIPOCIRE, derived from *adepts*, fat, and *cera*, wax, denotes a substance which has been lately examined by chemists. It is formed by a certain change which the soft parts of animal bodies undergo, when kept for some time in running water, or when a great number of dead bodies are heaped together in the same place. Great quantities of this substance were found on removing the animal matters from the burial ground of the *Innocens* at Paris in the year 1787. In this burial ground, 1200 or 1500 bodies were thrown together into the same pit, and being decomposed, were converted into this substance. It has some of the properties of wax or spermaceti. See *CHEMISTRY Index*.

ADIPOSE, a term used by anatomists for any cell, membrane, &c. that is remarkable for its fatness.

ADIRBEITSAN, in *Geography*, a province of Persia, in Asia, and part of the ancient Media. It is bounded on the north by the province of Schirvan, on the south by Irac-Agemi and Curdistan, on the east by Ghilan and the Caspian sea, and on the west by Turcomania. E. Long. 42°. to 48°. N. Lat. 36°. to 39°.

ADIT, in a general sense, the passage to, or entrance of, any thing.

ADIT of a Mine, the hole, or aperture, whereby it is entered and dug, and by which the water and ores are carried away. The term amounts to the same with *cuniculus* or *drift*, and is distinguished from *air-shaft*. The adit is usually made on the side of a hill, towards the bottom thereof, about four, five, or six feet high, and eight wide, in form of an arch; sometimes cut in the rock, and sometimes supported with timber, so conducted as that the sole or bottom of the adit may answer to the bottom of the shaft, only somewhat lower, that the water may have a sufficient current to pass away without the use of the pump. Damps and the impurity of the air are the great impediments against driving

Adhoa
||
Adit.

Adit || **Adjutant.**
driving adits above 20 or 30 fathoms, by reason of the necessity, in this case, of letting down air-shafts from the day to meet the adit, which are often very expensive, both on account of the great depth of mines, and the hardness of the mineral strata to be cut through. The best remedy against this is that practised in the coal mines near Liege, where they work their adits without air-shafts; the manner of which is described by Sir James Moray. (*Phil. Trans.* vol. i. p. 79.).

Adit of a Mine is sometimes used for the air-shaft itself, being a hole driven perpendicularly from the surface of the earth into some part of the mine, to give entrance to the air. To draw off the standing water in winter, in deep mines, they drive up an adit, or air-shaft, upon which the air disengages itself from the water, when it begins to run with such violence as produces a noise equal to the bursting of a cannon, dashes every thing in the way against the sides of the mine, and loosens the very rocks at a distance. (*Ibid.*)

ADJUDICATION, implies the act of adjudging, or determining, a cause in favour of some person.

ADJUDICATION, in *Scots Law*, the name of that action by which a creditor attaches the heritable estate of his debtor, or his debtor's heir, in order to appropriate it to himself, either in payment or security of his debt; or that action by which the holder of an heritable right, labouring under any defect in point of form, may supply that defect.

ADJUNCT, among philosophers, signifies something added to another, without being any necessary part of it. Thus water absorbed by cloth or a sponge, is an adjunct, but no necessary part of either of these substances.

ADJUNCT, in *Metaphysics*, some quality belonging to either the body or mind, whether natural or acquired. Thus thinking is an adjunct of the mind, and growth an adjunct of the body.

ADJUNCT, in *Music*, a word which is employed to denominate the connexion or relation between the principal mode and the modes of its two-fifths, which, from the intervals that constitute the relation between them and it, are called its *adjuncts*.

ADJUNCT is also used to signify a colleague, or some person associated with another as an assistant.

ADJUNCT Gods, or *ADJUNCTS of the Gods*, among the Romans, were a kind of inferior deities, added as assistants to the principal ones, to ease them in their functions. Thus, to Mars was adjoined Bellona and Nemesis; to Neptune, Salacia; to Vulcan, the Cabiri; to the Good Genius, the Lares; to the Evil, the Lemures, &c.

ADJUNCTS, in *Rhetoric* and *Grammar*, signify certain words or things added to others, to amplify or augment the force of the discourse.

ADJUNCTS, or **ADJOINTS**, in the Royal Academy of Sciences at Paris, denoted a class of members, attached to the pursuit of particular sciences. The class of *Adjuncts* was created in 1716, in lieu of the *Eleves*: they were twelve in number; two for geometry, two for mechanics, two for astronomy, two for anatomy, two for chemistry, and two for botany. The *Eleves* not taken into this establishment were admitted on the footing of supernumerary *Adjuncts*.

ADJUTANT, in the military art, is an officer whose business it is to assist the major. Each battalion

of foot and regiment of horse has an adjutant, who receives the orders every night from the brigade-major: which, after carrying them to the colonel, he delivers out to the serjeants. When detachments are to be made, he gives the number to be furnished by each company or troop, and assigns the hour and place of rendezvous. He also places the guards; receives and distributes the ammunition to the companies, &c.; and, by the major's orders, regulates the prices of bread, beer, and other provisions. The word is sometimes used by the French for an *aid-du-camp*.

ADJUTANTS-general, among the Jesuits, a select number of fathers, who resided with the general of the order, each of whom had a province or country assigned him, as England, Holland, &c. and their business was to inform the father-general of state occurrences in such countries. To this end they had their correspondents delegated, emissaries, visitors, regents, provincials, &c.

ADJUTORIUM, a term used by physicians for any medicine in a prescription but the capital one.

ADLE-EGGS, such as have not received an impregnation from the semen of the cock.

ADLEGATION, in the public law of the German empire, a right claimed by the states of the empire of adjoining plenipotentiaries, in public treaties and negotiations, to those of the emperor, for the transacting of matters which relate to the empire in general. In which sense *adlegation* differs from *legation*, which is the right of sending ambassadors on a person's own account.—Several princes and states of the empire enjoy the right of *legation*, which have not that of *adlegation*, and *vice versa*. The bishops, for instance, have the right of *adlegation* in the treaties which concern the common interest, but no right of *legation* for their own private affairs. The like had the duke of Mantua.—The emperor allows the princes of Germany the privilege of *legation*, but disputes that of *adlegation*. They challenge it as belonging to them *jure regni*, which they enjoy in common with the emperor himself.

ADLOCUTION, **ADLOCUTIO**, in *Antiquity*, is chiefly understood of speeches made by Roman generals to their armies, to encourage them before a battle. We frequently find those adlocutions expressed on medals by the abbreviation **ADLOCUT. COH.**—The general is sometimes represented as seated on a tribunal, often on a bank or mound of turf, with the cohorts ranged orderly round him, in *manipuli* and *turmæ*. The usual formula in adlocutions was, *Fortis esset ac fidus*.

ADMANUENSES, in ancient law books, denote persons who swore by laying their hands on the book.—In which sense, *admanuenses* amount to the same with laymen; and stand opposed to clerks, who were forbid to swear on the book, their word being reputed as their oath; whence they were also denominated *fide digni*.

ADMEASUREMENT, **ADMENSURATIO**, in *Law*, a writ which lies for the bringing those to reason, or mediocrity, who usurp more of any thing than their share. This writ lies in two cases; termed,

ADMEASUREMENT of Dower, *Admensuratio dotis*, where the widow of the deceased holds more from the heir, or his guardian, on account of her dower, than of right belongs to her. And,

A a

ADMEASUREMENT

Adjutant
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Admea-
surement.

Admea-
surement
||
Admini-
strator.

Admeasurement of Pasture, Admensuratio pasturæ; this lies between those who have COMMON of pastures appendant to their freehold, or common by vicinage, in case any of them surcharge the common with more cattle than they ought.

ADMINICLE, a term used chiefly in old law-books, to imply an aid, help, assistance, or support. The word is Latin, *adminiculum*; and derived from *adminiculus*, to prop or support.

ADMINICLE, in *Scots Law*, signifies any writing or deed referred to by a party, in an action of law, for proving his allegations.

ADMINICULATOR, an ancient officer of the church, whose business it was to attend to and defend the cause of the widows, orphans, and others destitute of help.

ADMINISTRATION, in general, the government, direction, or management of affairs, and particularly the exercise of distributive justice. Among ecclesiastics, it is often used to express the giving or dispensing the sacraments, &c.

ADMINISTRATION, is also the name given by the Spaniards in Peru to the staple magazine, or warehouse, established at Callao, a small town on the South sea, which is the port of Lima, the capital of that part of South America, and particularly of Peru. The foreign ships which have leave to trade along that coast are obliged to unload here, paying 13 per cent. of the price they sell for, if the cargo be entire, and even 16 per cent. if otherwise; besides which, they pay 3 per 1000, duty, for consulship and some other small royal rights and claims.

ADMINISTRATOR, in *Law*, he to whom the ordinary commits the administration of the goods of a person deceased, in default of an executor.—An action lies for or against an administrator, as for or against an executor; and he shall be accountable to the value of the goods of the deceased, and no farther:—unless there be waste, or other abuse chargeable on him. If the administrator die, his executors are not administrators; but the court is to grant a new administration.—If a stranger, who is neither administrator nor executor, take the goods of the deceased and administer, he shall be charged and sued as an executor, not as an administrator. The origin of administrators is derived from the civil law. Their establishment in England is owing to a statute made in the 31st year of Edward III. Till then, no office of this kind was known beside that of executor: in case of a want of which, the ordinary had the disposal of goods of persons intestate, &c.

ADMINISTRATOR, in *Scots Law*, a person legally empowered to act for another whom the law presumes incapable of acting for himself. Thus tutors or curators are sometimes styled *administrators in law* to pupils, minors, or fatuous persons. But more generally the term is used to imply that power which is conferred by the law upon a father over the persons and property of his children during their minority. See **LAW**.

ADMINISTRATOR is sometimes used for the president of a province: for a person appointed to receive, manage, and distribute, the revenues of an hospital or religious house; for a prince who enjoys the revenues of a secularized bishop; and for the regent of a king-

dom during the minority of a prince, or a vacancy of the throne.

ADMIRABILIS SAL, the same with **GLAUBER'S** salt.

ADMIRAL, a great officer or magistrate, who has the government of a navy, and the hearing of all maritime causes.

Authors are divided with regard to the origin and denomination of this important officer, whom we find established in most kingdoms that border on the sea. But the most probable opinion is that of Sir Henry Spelman, who thinks, that both the name and dignity were derived from the Saracens, and, by reason of the holy wars, brought amongst us; for *admiral*, in the Arabian language, signifies a prince, or chief ruler, and was the ordinary title of the governors of cities, provinces, &c. and therefore they called the commander of the navy by that name, as a name of dignity and honour. And indeed there are no instances of admirals in this part of Europe before the year 1284, when Philip of France, who had attended St Lewis in the wars against the Saracens, created an admiral. Du Cange assures us, that the Sicilians were the first, and the Genoese the next, who gave the denomination of *admiral* to the commanders of their naval armaments; and that they took it from the Saracen or Arabic *emir*, a general name for every commanding officer. As for the exact time when the word was introduced among us, it is uncertain; some think it was in the reign of Edward I. Sir Henry Spelman is of opinion that it was first used in the reign of Henry III. because neither the laws of Oleron, made in 1266, nor Bracton, who wrote about that time, make any mention of it; and that the term *admiral* was not used in a charter in the eighth of Henry III. where he granted this office to Richard de Lacy, by these words *Maritimam Angliæ*; but in the 56th year of the same reign, not only the historians, but the charters themselves, very frequently used the word *admiral*.

Anciently there were generally three or four admirals appointed in the English seas, all of them holding the office *durante bene placito*; and each of them having particular limits under their charge and government; as admirals of the fleet of ships, from the mouth of the Thames, northward, southward, or westward. Besides these, there were admirals of the Cinque Ports, as in the reign of Edward III. when one William Latimer was styled *admiralis quinque portuum*: and we sometimes find that one person has been admiral of the fleets to the southward, northward, and westward: but the title of *admiralis Angliæ* was not frequent till the reign of Henry IV. when the king's brother had that title given him, which in all commissions afterwards was granted to the succeeding admirals. It may be observed, that there was a title above that of admiral of England, which was, *locum tenens regis super mare*, the king's lieutenant general of the sea; this title we find mentioned in the reign of Richard II. Before the use of the word *admiral* was known, the title of *custos maris* was made use of. See **ADMIRAL**, SUPPLEMENT.

Lord High ADMIRAL of England, in some ancient records called *capitanus maritimarum*, an officer of great antiquity and trust, as appears by the laws of Oleron, so denominated from the place at which they were made by Richard I. The first title of *admiral of England*, expressly

Admini-
strator
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Admiral

Admiral. pressly conferred upon a subject, was given by patent of Richard II. to Richard Fitz-Allen, jun. earl of Arundel and Surrey; for those who before enjoyed this office were simply termed *admirals*, though their jurisdiction seems as extensive, especially in the reign of Edward III. when the court of admiralty was first erected.

This great officer has the management of all maritime affairs, and the government of the royal navy, with power of decision in all maritime causes both civil and criminal: he judges of all things done upon or beyond the sea, in any part of the world; upon the sea coasts, in all ports and havens, and upon all rivers below the first bridge from the sea. By him, vice-admirals, rear-admirals, and all sea captains, are commissioned: all deputies for particular coasts, and coroners to view dead bodies found on the sea coasts, or at sea: he also appoints the judges for his court of admiralty, and may imprison, release, &c. All ports and havens are *infra corpus comitatus*, and the admiral hath no jurisdiction of any thing done in them. Between high and low water mark, the common law and the high admiral have jurisdiction by turns, one upon the water, and the other upon the land.

The lord admiral has power, not only over the seamen serving in his ships of war, but over all other seamen, to arrest them for the service of the state; and if any of them run away, without leave of the admiral, he hath power to make a record thereof, and certify the same to the sheriffs, mayors, bailiffs, &c. who shall cause them to be apprehended and imprisoned.

To the lord high admiral belong all penalties and amercements of all transgressions at sea, on the sea shore, in ports and havens, and all rivers below the first bridge from the sea; the goods of pirates and felons condemned or enslaved, sea wrecks, goods floating on the sea, or cast on the shore (not granted to lords of manors adjoining to the sea), and a share of lawful prizes; also all great fishes, commonly called *royal fishes*, except whales and sturgeons: to which add, a salary of 7000*l.* a-year.

In short, this is so great an office, in point of trust, honour, and profit, that it has been usually given to princes of the blood, or the most eminent persons among the nobility. We have had no high admiral for some years; the office being put in commission, or under the administration of the lords commissioners of the admiralty, who by statute have the same power and authority as the lord high admiral.

Lord High ADMIRAL of Scotland, one of the great officers of the crown, and supreme judge in all maritime cases within that part of Britain. See *LAW*.

ADMIRAL also implies the commander in chief of any single fleet or squadron; or, in general, any flag-officer whatever. The commander of a fleet carries his flag at the main-top-mast head. Thus we say, *admiral of the red*, of the *white*, of the *blue*.

Vice-ADMIRAL, is the commander of the second squadron, and carries his flag at the fore-top-mast head.

Rear-ADMIRAL, is the commander of the third squadron, and carries his flag at the mizen-top-mast head.

Vice-ADMIRAL, is also an officer appointed by the lords commissioners of the admiralty. There are several of these officers established in different parts of Great Britain, with judges and marshals under them,

for executing jurisdiction within their respective limits. Their decrees, however, are not final, an appeal lying to the court of admiralty in London. **Admiral, Admiralty.**

ADMIRAL is also an appellation given to the most considerable ship of a fleet of merchantmen, or of the vessels employed in the cod fishery of Newfoundland. This last has the privilege of choosing what place he pleases on the shore to dry his fish; gives proper orders, and appoints the fishing places to those who come after him; and as long as the fishing season continues, he carries a flag on his main-mast.

ADMIRAL, in *Conchology*, the English name of a species of the voluta, a shell-fish belonging to the order of vermes testacea. See *CONCHOLOGY Index*.

ADMIRALTY properly signifies the office of lord high admiral, whether discharged by one single person, or by joint commissioners called *lords of the admiralty*.

Court of ADMIRALTY, is a sovereign court, held by the lord high admiral, or lords of the admiralty, where cognizance is taken in all maritime affairs, whether civil or criminal.—All crimes committed on the high seas, or on great rivers below the first bridge next the sea, are cognizable in this court only, and before which they must be tried by judge and jury. But in civil cases the mode is different, the decisions being all made according to the civil law. From the sentences of the admiralty judge an appeal always lay, in ordinary course, to the king in chancery, as may be collected from statute 25 Hen. VIII. c. 19. which directs the appeal from the archbishop's courts to be determined by persons named in the king's commission, "like as in case of appeal from the admiral court." And by statute 8 Eliz. c. 5. it is enacted, that upon an appeal made to the chancery, the sentence definitive of the delegates appointed by commission shall be final.

Appeals from the vice-admiralty courts in America, and our other plantations and settlements, may be brought before the courts of admiralty in England, as being a branch of the admiral's jurisdiction, though they may also be brought before the king in council. But in case of prize vessels, taken in time of war, in any part of the world, and condemned in any courts of admiralty, the appeal lies to certain *commissioners of appeals* consisting chiefly of the privy council. And this by virtue of divers treaties with foreign nations, by which particular courts are established in all the maritime countries of Europe for the decision of this question, Whether lawful prize or not? for this being a question between subjects of different states, it belongs entirely to the law of nations, and not to the municipal laws of either country. See a more full account of the various courts of admiralty, and of their powers and practices, under the article *ADMIRALTY* in the *SUPPLEMENT*.

Court of ADMIRALTY, in Scotland. See *LAW*.

ADMIRALTY Bay, in *Geography*, a spacious bay with good anchorage on the west coast of Cook's straits, in the southern island of New Zealand. S. Lat. 40. 37. E. Long. 174. 54.

There is a bay of the same name on the north-west coast of America, in N. Lat. 59. 31. W. Long. 140. 18.

ADMIRALTY Inlet, the entrance to the supposed straits of Juan de Fuca, on the west coast of New Georgia,

Admiralty
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Adoles-
cence.

in N. Lat. 48. 30. W. Long. 124. 15. It was visited by Captain Vancouver in 1792, who found the soil on the shores rich and fertile, well watered, and clothed with luxuriant vegetation.

ADMIRALTY Islands, lie in about 2° 18' S. Lat. and 146° 44' E. Long. There are between 20 and 30 islands said to be scattered about here, one of which alone would make a large kingdom. Captain Carteret, who first discovered them, was prevented from touching at them, although their appearance was very inviting, on account of the condition of his ship, and of his being entirely unprovided with the articles of barter which suit an Indian trade. He describes them as clothed with a beautiful verdure of woods, lofty and luxuriant, interspersed with spots that have been cleared for plantations, groves of cocoa nut trees, and houses of the natives, who seem to be very numerous. The largest of these islands is 18 leagues long in the direction of east and west. The discoverer thinks it highly probable that these islands produce several valuable articles of trade, particularly spices, as they lie in the same climate and latitude as the Moluccas.

ADMIRATION, in ethics, is that passion of the mind which is excited by the contemplation of superior and rare excellence, as superior or uncommon wisdom, ingenuity, or benevolence.

ADMONITION, in ecclesiastical affairs, a part of discipline much used in the ancient church. It was the first act, or step, towards the punishment or expulsion of delinquents. In cases of private offences, it was performed, according to the evangelical rule, privately: in case of public offence, openly, before the church. If either of those sufficed for the recovery of the fallen person, all further proceedings in the way of censure ceased: if they did not, recourse was had to excommunication.

ADMONITIO Fustium, a military punishment among the Romans, not unlike our whipping, but it was performed with vine branches.

ADMORTIZATION, in the feudal customs, the reduction of the property of lands or tenements to mortmain. See *MORTMAIN*.

ADNATA, in *Anatomy*, one of the coats of the eye, which is also called *conjunctiva* and *albuginea*.

ADNATA is also used for any hair, wool, or the like, which grows upon animals or vegetables.

ADNATA, or *Adnascentia*, among gardeners, denote those offsets, which by a new germination under the earth, proceed from the lily, narcissus, hyacinth, and other flowers, and afterwards become true roots.

ADNOUN, is used by some grammarians to express what we more usually call an adjective.—The word is formed by way of analogy to adverb; in regard adjectives have much the same office and relation to nouns that adverbs have to verbs. Bishop Wilkins uses the word *adname* in another sense, viz. for what we otherwise call a preposition.

ADOLESCENCE, the state of growing youth; or that period of a person's age, commencing from his infancy, and terminating at his full stature or manhood. The word is formed of the Latin *adolescere*; "to grow."—The state of adolescence lasts so long as the fibres continue to grow, either in magnitude or firmness. The fibres being arrived at the degree of firmness and tension sufficient to sustain the parts, no longer

yield or give way to the efforts of the nutritious matter to extend them; so that their farther accretion is stopped, from the very law of their nutrition. Adolescence is commonly computed to be between 15 and 25, or even 30 years of age; though in different constitutions its terms are very different.—The Romans usually reckoned it from 12 to 25 in boys: and to 21 in girls, &c. And yet, among their writers, *juvenis* and *adolescens* are frequently used indifferently for any person under 45 years.

ADOLLAM, or *ODOLLAM*, in *Ancient Geography*, a town in the tribe of Judah, to the east of Eleutheropolis. David is said to have hid himself in a cave near this town, (Bible).

ADOM, in *Geography*, a state or principality of the Gold coast, in Africa. It is a populous, rich, and fertile country, abounding with corn and fruits.

ADON, a populous village in the province of Stuhl-Weissenberg, belonging to Hungary. It lies in a fruitful country, towards the river Danube. E. Long. 19. 20. N. Lat. 47. 30.

ADONAI, one of the names of the Supreme Being in the Scriptures. The proper meaning of the word is *my lords*, in the plural number; as *Adoni* is *my lord*, in the singular. The Jews, who either out of respect, or superstition, do not pronounce the name of *Jehovah*, read *Adonai*, in the room of it, as often as they meet with *Jehovah* in the Hebrew text. But the ancient Jews were not so scrupulous; nor is there any law which forbids them to pronounce the name of God, (Calmet.)

ADONIA, in antiquity, solemn feasts in honour of Venus, and in memory of her beloved Adonis. The Adonia were observed with great solemnity by most nations; Greeks, Phœnicians, Lycians, Syrians, Egyptians, &c. From Syria, they are supposed to have passed into India. The prophet Ezekiel* is understood to speak of them. They were still observed at Alexandria in the time of St Cyril; and at Antioch in that of Julian the Apostate, who happened to enter that city during the solemnity, which was taken for an ill omen. The Adonia lasted two days: on the first of which certain images of Venus and Adonis were carried, with all the pomp and ceremonies practised at funerals: the women wept, tore their hair, beat their breasts, &c. imitating the cries and lamentations of Venus for the death of her paramour. This lamentation they called *Adoniaques*. The Syrians were not contented with weeping, but subjected themselves to severe discipline, shaved their heads, &c. Among the Egyptians, the queen herself used to carry the image of Adonis in procession. St Cyril mentions an extraordinary ceremony practised by the Alexandrians: A letter was written to the women of Byblus, to inform them that Adonis was found again: this letter was thrown into the sea, which (it was pretended) did not fail punctually to convey it to Byblus in seven days; upon the receipt of which, the Byblian women ceased their mourning, sung his praises, and made rejoicings as if he were raised to life again: Or rather, according to Meursius, the two offices of mourning and rejoicing made two distinct feasts, which were held at different times of the year, the one six months after the other, Adonis being supposed to pass half the year with Proserpine, and half with Venus.—The Egyptian Adonia are said to have been held in memory

Adoles-
cence
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Adonia.

* Ch. viii.
xiv.

Adonia
||
doptiani.

memory of the death of Osiris; by others of his sickness and recovery. Bishop Patrick dates their origin from the slaughter of the first born under Moses.

ADONIDES, in *Botany*, a name given to botanists who described or made catalogues of plants cultivated in any particular place.

ADONIS, son of Cynaras king of Cyprus, the darling of the goddess Venus: being killed by a wild boar, in the Idalian woods, he was turned into a flower of a blood-colour, supposed to be the anemone. Venus was inconsolable; and no grief was ever more celebrated than this, most nations having perpetuated the memory of it by a train of anniversary ceremonies*. Among Shakespeare's poems, is a long one on the subject of Venus's affection for Adonis.

See Ado-
n.

The text of the vulgate in Ezekiel viii. 14. says, that this prophet saw women sitting in the temple, and weeping for Adonis: but according to the reading of the Hebrew text, they are said to weep for Thammuz, or the *hidden one*. Among the Egyptians, Adonis was adored under the name of Osiris the husband of Isis. But he was sometimes called by the name of Ammuz, or Thammuz, *the concealed*, to denote probably his death or burial. The Hebrews, in derision, call him sometimes *the dead*, Psal. cvi. 28. and Lev. xix. 28. because they wept for him, and represented him as one dead in his coffin; and at other times, they call him the *image of jealousy*, Ezek. viii. 3. 5. because he was the object of the god Mar's jealousy. The Syrians, Phœnicians, and Cyprians, called him Adonis; and F. Calmet is of opinion, that the Ammonites and Moabites gave him the name of Baal-peor. See BAAL-PEOR.

ADONIS, *Adonius*, in *Ancient Geography*, a river of Phœnicia, rising in Mount Lebanon, and falling into the sea, after a north-west course, at Byblus; famous in fable, as a beautiful shepherd youth (Virgil); son of Cynaras, king of the Cyprians, loved by Venus, slain by a boar, and turned into a river. Theocritus laments him dead in an idyllion, or rather ode, as did the women yearly, when, in flood time, the river rolled down a red earth, which tinged its waters, deemed to be his wound bleeding afresh. In the Phœnician language Adan signifies a willow, and Adon lord, with the same radical letters. Hence, *Ἰταῖος Ἀδωνίς*, *Salignus*, and *Κυρίος* or *Κυρίος Ἀδωνίς* for *Κυρίος*. *Adonis horti*, are gardens beautifully arranged, but more adapted for pleasure than profit.

ADONIS, *Bird's eye*, or *Pheasant's eye*, in *Botany*. See BOTANY Index.

ADONISTS, a sect or party among divines and critics, who maintain, that the Hebrew points ordinarily annexed to the consonants of the word Jehovah, are not the natural points belonging to that word, nor express the true pronunciation of it; but are the vowel points, belonging to the words *Adonia* and *Elohim*, applied to the consonants of the ineffable name Jehovah, to warn the readers, that instead of the word Jehovah, which the Jews were forbidden to pronounce, and the true pronunciation of which had been long unknown to them, they are always to read *Adonai*. They are opposed to *Jehovists*: of whom the principal are Drusius, Capellus, Buxtorf, Altling, and Reland, who has published a collection of their writings on this subject.

ADOPTIANI, in church history, a sect of ancient

heretics, followers of Felix of Urgel, and Elipand of Toledo, who, towards the end of the eighth century, advanced the notion, that Jesus Christ, in his human nature, is the Son of God, not by nature, but by adoption.

Adoptiani,
Adoption.

ADOPTION, an act by which any one takes another into his family, owns him for his son, and appoints him for his heir.

The custom of adoption was very common among the ancient Greeks and Romans; yet it was not practised, but for certain causes expressed in the laws, and with certain formalities usual in such cases. It was a sort of imitation of nature, intended for the comfort of those who had no children: wherefore he that was to adopt was to have no children of his own, and to be past the age of getting any; nor were eunuchs allowed to adopt, as being under an actual impotency of begetting children; neither was it lawful for a young man to adopt an elder, because that would have been contrary to the order of nature; nay, it was even required that the person who adopted should be eighteen years older than his adopted son, that there might at least appear a probability of his being the natural father.

Among the Greeks it was called *ἰουσις*, *filiation*. It was allowed to such as had no issue of their own; excepting those who were not *κυριοὶ ἑαυτῶν*, *their own masters*, e. g. slaves, women, madmen, infants, or persons under twenty years of age; who being incapable of making wills, or managing their own estates, were not allowed to adopt heirs to them. Foreigners being incapable of inheriting at Athens, if any such were adopted, it was necessary first to make them free of the city. The ceremony of adoption being over, the adopted had his name enrolled in the tribe and ward of his new father; for which entry a peculiar time was allotted, viz. the festival *Θαργηλια*. To prevent rash and inconsiderate adoptions, the Lacedæmonians had a law, that adoptions should be transacted, or at least confirmed, in the presence of their kings. The children adopted were invested with all the privileges, and obliged to perform all the duties, of natural children; and being thus provided for in another family, ceased to have any claim of inheritance, or kindred, in the family which they had left, unless they first renounced their adoption; which, by the laws of Solon, they were not allowed to do, unless they had first begotten children, to bear the name of the person who had adopted them: thus providing against the ruin of families, which would otherwise have been extinguished by the desertion of those who had been adopted to preserve them. If the children adopted happened to die without children, the inheritance could not be alienated from the family into which they had been adopted, but returned to the relations of the adopter. It should seem, that by the Athenian law, a person, after having adopted another, was not allowed to marry without permission from the magistrate: in effect, there are instances of persons, who being ill used by their adoptive children, petitioned for such leave. However this be, it is certain some men married after they had adopted sons: in which case, if they begat legitimate children, their estates were equally shared between the begotten and adopted.

The Romans had two forms of adoption; one before

Adoption. fore the prætor; the other at an assembly of the people, in the times of the commonwealth, and afterwards by a rescript of the emperor. In the former, the natural father addressed himself to the prætor, declaring that he emancipated his son, resigned all his authority over him, and consented he should be translated into the family of the adopter. The latter was practised, where the party to be adopted was already free; and this was called *adrogation*. The person adopted changed all his names; assuming the prename, name, and surname, of the persons who adopted him.

Besides the formalities prescribed by the Roman law, various other methods have taken place; which have given denominations to different species of adoption, among the Gothic nations, in different ages. As,

ADOPTION by arms, was when a prince made a present of arms to a person, in consideration of his merit and valour. Thus it was that the king of the Heruli was adopted by Theodoric; Athalaric by the emperor Justinian; and Cosroes, nephew of the king of Persia, by the emperor Justin.—The obligation here laid on the adoptive son was, to protect and defend the father from injuries, affronts, &c. And hence, according to Selden, the ceremony of dubbing knights took its origin as well as name.

ADOPTION by baptism, is that spiritual affinity which is contracted by god-fathers and god-children in the ceremony of baptism. This kind of adoption was introduced into the Greek church, and came afterwards into use among the ancient Franks, as appears by the Capitulars of Charlemagne.

In reality, the god-father was so far considered as adoptive father, that his god-children were supposed to be entitled to a share in the inheritance of his estate.

ADOPTION by hair, was performed by cutting off the hair of a person, and giving it to the adoptive father. It was thus that Pope John VIII. adopted Boson king of Arles; which, perhaps, is the only instance in history of adoption, in the order of the ecclesiastics; a law that professes to imitate nature, not daring to give children to those in whom it would be thought a crime to beget any.

ADOPTION by matrimony, is the taking the children of a wife or husband, by a former marriage, into the condition of proper or natural children; and admitting them to inherit on the same footing with those of the present marriage. This is a practice peculiar to the Germans: among whom, it is more particularly known by the name of *einkindschaft*; among their writers in Latin, by that of *unio prolium*, or *union of issues*. But the more accurate writers observe, that this is no adoption. See **ADFILIAION**.

ADOPTION by testament, that performed by appointing a person heir by will, on condition of his assuming the name, arms, &c. of the adopter. Of which kind we meet with several instances in the Roman history.

Among the Turks, the ceremony of adoption is performed by obliging the person adopted to pass through the shirt of the adopter. Hence, among that people, to adopt, is expressed by the phrase, *to draw another through my shirt*. It is said, that something like this has also been observed among the Hebrews; where the prophet Elijah adopted Elisha for his son and successor, and communicated to him the gift of prophecy, by let-

ting fall his cloak or mantle on him. But adoption, properly so called, does not appear to have been practised among the ancient Jews: Moses says nothing of it in his laws; and Jacob's adoption of his two grandsons, Ephraim and Manasseh, is not so properly an adoption, as a kind of substitution, whereby those two sons of Joseph were allotted an equal portion in Israel with his own sons.

ADOPTION is also used, in *Theology*, for a federal act of God's free grace; whereby those who are regenerated by faith, are admitted into his household, and entitled to a share in the inheritance of the kingdom of heaven.

ADOPTION is sometimes also used, in speaking of the ancient clergy, who had a custom of taking a maid or widow into their houses, under the denomination of an *adoptive* or *spiritual sister* or *niece*.

ADOPTION is also used in speaking of the admission of persons into certain hospitals, particularly that of Lyons, the administrators whereof have all the power and rights of parents over the children admitted.

ADOPTION is also used for the reception of a new academy into the body of an old one.—Thus

The French academy of Marseilles was adopted by that of Paris: on which account, we find a volume of speeches extant, made by several members of the academy of Marseilles, deputed to return thanks to that of Paris for the honour.

In a similar sense, adoption is also applied by the Greeks, to the admitting a monk, or brother, into a monastic community; sometimes called *spiritual adoption*.

ADOPTIVE, denotes a person or thing adopted by another.

Adoptive children, among the Romans, were on the same footing with natural ones; and accordingly were either to be instituted heirs, or expressly disinherited, otherwise the testament was null. The emperor Adrian preferred adoptive children to natural ones; because we choose the former, but are obliged to take the latter at random.

M. Menage has published a book of cluges, or verses addressed to him; which he calls *Liber Adoptivus*, an adoptive book; and adds it to his other works.—Heinsius, and Furstemburg of Munster, have likewise published adoptive books.

In ecclesiastical writers we find adoptive women, or sisters, (*adoptivæ faminae* or *sorores*), used for those handmaids of the ancient clergy, otherwise called *subintroductæ*.

ADOPTIVE arms, are those which a person enjoys by the gift or concession of another, and to which he was not otherwise entitled. They stand contradistinguished from arms of alliance.

We sometimes meet with adoptive heir, by way of opposition to natural heir; and adoptive gods, by way of contradistinction to domestic ones. The Romans, notwithstanding the number of their domestic, had their adoptive gods, taken chiefly from the Egyptians: such were Isis, Osiris, Anubis, Apis, Harpocrates, and Canopus.

ADORATION, the act of rendering divine honours; or of addressing a being, as supposing it a god. The word is compounded of *ad*, "to," and *oris*, "mouth;" and literally signifies to apply the hand

Adoption
Adoration.

Adoration

to the mouth; *Manum ad os admove*re, q. d. "to kiss the hand;" this being, in the eastern countries, one of the great marks of respect and submission.—The Romans practised adoration at sacrifices, and other solemnities; in passing by temples, altars, groves, &c. at the sight of statues, images, or the like, whether of stone or wood, wherein any thing of divinity was supposed to reside. Usually there were images of the gods placed at the gates of cities, for those who went in or out, to pay their respects to.—The ceremony of adoration among the ancient Romans was thus: The devotee having his head *covered*, applied his right hand to his lips, the fore finger resting on his thumb, which was erect, and thus bowing his head, turned himself round from left to right. The kiss thus given was called *osculum labratum*; for ordinarily they were afraid to touch the images of their gods themselves with their profane lips. Sometimes, however, they would kiss their feet, or even knees, it being held an incivility to touch their mouths; so that the affair passed at some distance. Saturn, however, and Hercules, were adored with the head *bare*; whence the worship of the last was called *institutum peregrinum*, and *ritus Græcanicus*, as departing from the customary Roman method, which was to sacrifice and adore with the face veiled, and the clothes drawn up to the ears, to prevent any interruption in the ceremony by the sight of unlucky objects.—The Jewish manner of adoration was by prostration, bowing, and kneeling.—The Christians adopted the Grecian rather than the Roman method, and adored always *uncovered*. The ordinary posture of the ancient Christians was kneeling, but on Sundays standing; and they had a peculiar regard to the east, to which point they ordinarily directed their prayers.

ADORATION is more particularly used for the act of praying or preferring our requests or thanksgivings to Almighty God.

ADORATION is also used for certain extraordinary civil honours or respects which resemble those paid to the Deity, yet are given to men.

The Persian manner of adoration, introduced by Cyrus, was by bending the knee, and falling on the face at the prince's feet, striking the earth with the forehead, and kissing the ground. This ceremony, which the Greeks called *προσκύνησις*, Conon refused to perform to Artaxerxes, and Callisthenes to Alexander the Great, as repugnant to it impious and unlawful.

The adoration performed to the Roman and Grecian emperors consisted in bowing or kneeling at the prince's feet, laying hold of his purple robe, and presently withdrawing the hand and clapping it to the lips. Some attribute the origin of this practice to Constantius. It was only persons of some rank or dignity that were entitled to the honour. Bare kneeling before the emperor to deliver a petition, was also called *adoration*.

The practice of adoration may be said to be still subsisting in England, in the ceremony of kissing the king's or queen's hand, and in serving them at table, both being performed kneeling.

ADORATION is more particularly used for kissing one's hand in presence of another, as a token of reverence. The Jews adored by kissing their hands and bowing down their heads; whence, in their language, *kissing* is properly used for *adoration*.

ADORATION is also used among Roman writers for

a high species of applause given to persons who had spoken or performed well in public. See ACCLAMATION). We meet with adoration paid to orators, actors, musicians, &c. The method of expressing it was, by rising, putting both hands to their mouth, and then returning them towards the person intended to be honoured.

Adoration

Adorea.

ADORATION is also used in the court of Rome, for the ceremony of kissing the pope's feet.—The introduction of adoration among the Romans is ascribed to the low flattery of Vitellius, who, upon the return of C. Cæsar from Syria, would not approach him otherwise than with his head covered, turning himself round, and then falling on his face. Heliogabalus restored the practice, and Alexander Severus again prohibited it. Dioclesian redemanded it; and it was, in some measure, continued under the succeeding princes, even after the establishment of Christianity, as Constantine, Constantius, &c. It is particularly said of Dioclesian, that he had gems fastened to his shoes, that divine honours might be more willingly paid him, by kissing his feet. The like usage was afterwards adopted by the popes, and is observed to this day. These prelates, finding a vehement disposition in the people to fall down before them and kiss their feet, procured crucifixes to be fastened on their slippers; by which stratagem, the adoration intended for the pope's person is supposed to be transferred to Christ. Divers acts of this adoration we find offered even by princes to the pope.

ADORATION is also used for a method of electing a pope. The election of popes is performed two ways; by *adoration* and by *scrutiny*. In election by adoration, the cardinals rush hastily, as if agitated by some spirit, to the adoration of some one among them, to proclaim him pope. When the election is carried by scrutiny, they do not adore the new pope till he is placed on the altar.

Barbarous ADORATION is a term used, in the laws of King Canute, for that performed after the manner of the heathens who adored idols. The Romish church is charged with the adoration of saints, martyrs, images, crucifixes, relics, the virgin, and the host; all which by Protestants are generally aggravated into idolatry, on a supposition, that the honour thus paid to them is absolute and supreme, called by way of distinction *Latria*, which is due only to God. The Roman Catholics, on the contrary, explain them, as only a relative or subordinate worship, called *Dulia* and *Hyperdulia*, which terminates ultimately in God alone. But may not the same be said of the idol worship of the heathens? The Phœnicians adored the winds, on account of the terrible effects produced by them; the same was adopted by most of the other nations, Persians, Greeks, Romans, &c. The Persians chiefly paid their adorations to the sun and fire; some say also to rivers, the wind, &c. The motive of adoring the sun was the benefits they received from that glorious luminary, which of all creatures has doubtless the best pretensions to such homage.

ADOREA, in Roman antiquity, a word used in different senses; sometimes for all manner of grain, sometimes for a kind of cakes made of fine flour, and offered in sacrifice; and finally for a dole or distribution of corn, as a reward for some service; whence by metonymy it is put for praise or rewards in general.

ADOSCUATION,

Adoscula-
tion
||
Adranum.

ADOSCULATION, a term used by Dr Grew, to imply a kind of impregnation, without intromission; and in this manner he supposes the impregnation of plants is effected by the falling of the farina fecundans on the pistil.

ADOSSEE', in *Heraldry*, signifies two figures or bearings being placed back to back.

ADOUR, the name of a river of France, which rises in the mountains of Bigorre, in the department of the Upper Pyrenees, and running north by Tarbes through Gascony, afterwards turns east, and passing by Dax, falls into the bay of Biscay, below Bayonne.

ADOWA, the capital of Tigré in Abyssinia, is situated on the declivity of a hill on the west side of a small plain, which is surrounded on every side by mountains. The name, signifying *pass* or *passage*, is characteristic of its situation; for the only road from the Red sea to Gondar passes by Adowa. The town consists of 300 houses, is the residence of the governor, and has a manufactory of coarse cotton cloth which circulates in Abyssinia as the medium of exchange in place of money. N. Lat. 14. 7. E. Long. 38. 50.

ADOXA, **TUBEROUS MOSCHATEL**, **HOLLOW-ROOT**, or **INGLORIOUS**, in *Botany*. See **BOTANY Index**.

AD PONDUS OMNIUM, among physicians, an abbreviation in their prescriptions, signifying that the last-mentioned ingredient is to weigh as much as all the rest together.

Ad Quod Damnum, in the *English Law*, a writ directed to the sheriff, commanding him to inquire into the damage which may arise from granting certain privileges to a place, as a fair, a market, or the like.

ADRA, in *Geography*, a sea-port town of the province of Granada, in Spain, 47 miles south-east of Granada. N. Lat. 36. 42. E. Long. 2. 37.

ADRACHNE, in *Botany*, a species of the strawberry tree. See **ARBUTUS**, **BOTANY Index**.

ADRAMMELECH, one of the gods of the inhabitants of Sepharvaim, who were settled in the country of Samaria, in the room of those Israelites who were carried beyond the Euphrates. The Sepharvaites made their children pass through the fire, in honour of this idol and another called *Anamelech*. It is supposed, that Adrammelech meant the sun, and Anamelech the moon: the first signifies the *magnificent king*; the second the *gentle king*.

ADRAMYTTIUM, in *Ancient Geography*, now *Andramiti*, a town of Mysia Major, at the foot of Mount Ida, an Athenian colony, with a harbour and dock near the Caicus. *Adramytenus* the epithet; as, *Adramytenus Sinus*, a part of the Egean sea, on the coast of Mysia; *Adramytenus Conventus*, sessions or assizes, the eighth in order of the nine *Conventus Juridici* of the province of Asia.

ADRANA, a river of Germany (Polybius); now the Eder, rising on the borders of the county of Nassau, to the north-east of, and not far from Dillenburg, running through the landgraviate of Hesse, the county of Waldeck, by Fritzlar, and then again through the landgraviate, and, together with the Fulda, falling into the Weser, to the south of, and not far from Cassel.

ADRANUM, or **HADRANUM**, in *Ancient Geography*, now **ADERNO**, which see.

ADRASTEIA, in mythology, was the daughter of Jupiter and Necessity, and, according to Plutarch, the only fury who executed the vengeance of the gods. The name is derived from King Adrastus, who first erected a temple to that deity.

ADRASTEIA Certamina, in antiquity, a kind of Pythian games, instituted by Adrastus king of Argos, in the year of the world 2700, in honour of Apollo, at Sicyon. These are to be distinguished from the Pythian games celebrated at Delphi.

ADRASTUS, in ancient history, king of Argos, son of Talaus and Lysianissa, daughter of Polybius king of Sicyon, acquired great honour in the famous war of Thebes, in support of Polynices his son-in-law, who had been excluded the sovereignty of Thebes by Eteocles his brother, notwithstanding their reciprocal agreement. Adrastus, followed by Polynices, and Tydeus his other son-in-law, by Capaneus and Hippomedon his sister's sons, by Amphiarus his brother-in-law, and by Parthenopæus, marched against the city of Thebes; and this is the expedition of the Seven Worthies, which the poets have so often sung. They all lost their lives in this war except Adrastus, who was saved by his horse called *Arion*. This war was revived ten years after by the sons of those deceased warriors, which was called the *war of the Epigones*, and ended with the taking of Thebes. None of them lost their lives except Ægialeus son of Adrastus; which afflicted him so much that he died of grief in Megara, as he was leading back his victorious army.

ADRAZZO, or **AJACCIO**. The same with **ADJAZZO**, which see.

ADRIA, or **HADRIA**, in *Ancient Geography*, the name of two towns in Italy. One in the country of the Veneti, on the river Tartarus, between the Padus and the Athesis, called *Atria* by Pliny and Ptolemy, but *Adrias* by Strabo. Another on the river Vomanus, in the territory of the Piceni (to which Antonine's Itinerary from Rome is directed), the country of the ancestors of the emperor Adrian. From which of these the Adriatic sea is denominated, is matter of doubt. A third opinion is, that it is so called from Adrias the son of Joan, of Italian origin; (Eustathius in Dionysium).

ADRIAN, or **HADRIAN**, **PUBLIUS ÆLIUS**, the Roman emperor. He was born at Rome the 24th of January, in the 76th year of Christ, A. U. C. 829. His father left him an orphan, at ten years of age, under the guardianship of Trajan, and Coelius Tatianus a Roman knight. He began to serve very early in the armies, having been tribune of a legion before the death of Domitian. He was the person chosen by the army of Lower Moesia, to carry the news of Nerva's death to Trajan, successor to the empire. Trajan, however, conceived some prejudices against him, and Adrian perceiving that he was no favourite with the emperor, endeavoured to ingratiate himself with the empress Plotina, by which means he succeeded in obtaining for his wife, Sabina, the emperor's grand-niece and next heiress. This was probably the first step to his future advancement, and facilitated his ascent to the throne. As quæstor he accompanied Trajan in most of his expeditions, and particularly distinguished himself in the second war against the Dacians. Afterwards he was successively tribune of the people, prætor, governor

Adraste
||
Adrian

Adrian. governor of Pannonia, and consul. After the siege of Atræ in Arabia was raised, Trajan, who had already given him the government of Syria, left him the command of the army: and at length, when he found death approaching, it is said he adopted him. Adrian, who was then in Antiochia, as soon as he received the news thereof, and of Trajan's death, declared himself emperor, on the 11th of August, A. D. 117.

No sooner had he arrived at the imperial dignity, than he made peace with the Persians, to whom he yielded up great part of the conquests of his predecessors; and from generosity, or policy, he remitted the debts of the Roman people, which, according to the calculation of those who have reduced them to modern money, amounted to 22,500,000 golden crowns; and he burnt all the bonds and obligations relating to those debts, that the people might be under no apprehension of being called to an account for them afterwards. There are medals in commemoration of this fact, in which he is represented holding a flambeau in his hand, to set fire to all those bonds which he had made void. He went to visit all the provinces; and did not return to Rome till the year 118, when the senate decreed him a triumph, and honoured him with the title of *Father of his country*; but he refused both, and desired that Trajan's image might triumph. No prince travelled more than Adrian; there being hardly one province in the empire which he did not visit. In 120 he went into Gaul; from thence he went over to Britain, in order to subdue the Caledonians, who were making continual inroads into the provinces. Upon his arrival they retired towards the north: he advanced, however, as far as York, where he was diverted from his intended conquest by the description some old soldiers he found there, who had served under Agricola, gave him of the country. In hopes, therefore, of keeping them quiet, by enlarging their bounds, he delivered up to the Caledonians all the lands lying between the two friths and the Tyne; and, at the same time, to secure the Roman province from their future incursions, built the famous wall which still bears his name (A). Having thus settled matters in Britain, he returned to Rome, where he was honoured with the title of Restorer of Britain, as appears by some medals. He soon after went into Spain, to Mauritania, and at length into the East, where he quieted the commotions raised by the Parthians. After having visited all the provinces of Asia, he returned to Athens in 125, where he passed the

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winter, and was initiated in the mysteries of Eleusinian Ceres. He went from thence to Sicily, chiefly to view Mount Ætna, contemplate its phenomena, and enjoy the beautiful and extensive prospect afforded from its top. He returned to Rome the beginning of the year 129; and, according to some, he went again, the same year, to Africa; and, after his return from thence, to the east. He was in Egypt in the year 132, revisited Syria the year following, returned to Athens in 134, and to Rome in 135. The persecution against the Christians was very violent under his reign; but it was at length suspended, in consequence of the remonstrances of Quadratus bishop of Athens, and Aristides, two Christian philosophers, who presented the emperor with some books in favour of the Christian religion. He conquered the Jews: and, by way of insult, erected a temple to Jupiter on Calvary, and placed a statue of Adonis in the manger of Bethlehem; he caused also the images of swine to be engraven on the gates of Jerusalem. At last he was seized with a dropsy, which vexed him to such a degree, that he became almost raving mad. A great number of physicians were sent for, and to the multitude of them he ascribed his death. He died at Baïæ in the 63d year of his age, having reigned 21 years. The Latin verses he addressed to his soul, which he composed a short time before his death, in a strain of tender levity, have been much criticised, and have been the subject of numerous translations and imitations.

Adrian.

*Animula vagula, blandula,
Hospes, comesque corporis,
Quæ nunc abibis in loca
Pallidula, rigida, nudula,
Nec, ut soles, dabis jocos?*

Ah! fleeting spirit! wand'ring fire,
That long hast warm'd my tender breast,
Must thou no more this frame inspire?
No more a pleasing cheerful guest?
Whither, ah whither art thou flying?
To what dark undiscover'd shore?
Thou seem'st all trembling, shiv'ring, dying,
And wit and humour are no more!

POPE.

Some fragments of his Latin poetry are still extant, and there are Greek verses of his in the Anthology. He also wrote the history of his own life; to which, however, he did not choose to put his name; but that

B b

of

(A) This work, though called by the Roman historians *murus*, which signifies a wall of stone, was only composed of earth covered with green turf. It was carried on from the Solway frith, a little west of the village of Burgh on the Sands, in as direct a line as possible, to the river Tyne on the east, at the place where the town of Newcastle now stands; so that it must have been above 60 English, and near 70 Roman miles in length. It consisted of four parts: 1. The principal *agger*, mound of earth or rampart, on the brink of the ditch. 2. The ditch on the north side of the rampart. 3. Another rampart on the south side of the principal one, about five paces distant from it. 4. A large rampart on the north side of the ditch.—This last was probably the military way to the line of forts on this work: it was so to those formerly built by Agricola: and if it did not serve the same purpose in this, there must have been no military way attending it.—The south rampart might serve for an inner defence in case the enemy should beat them from any part of the principal rampart, or it might be designed to protect the soldiers from any sudden attack of the provincial Britons.—For many ages, this work hath been in so ruinous a condition, that it is impossible to discover its original dimensions with certainty. From their appearance, it seems probable that the principal rampart was at least 10 or 12 feet high,

Adrian.
* *Vide*
Spartian,
in Adriano.

of Phlegon, one of his freed-men, a very learned person, was prefixed to it*. He had great wit and a retentive memory, and he distinguished himself in the various branches of literature and science. In his natural disposition he was suspicious, envious, cruel, and lascivious. In his character there was a strange composition of virtues and vices. He was affable, courteous, and liberal; but he was capricious and unsteady in his attachments, and violent in his resentment. Thus he was distrusted by his friends, and dreaded by his enemies. Antoninus his successor obtained his apotheosis; and prevented the rescision of his acts, which the senate once intended.

ADRIAN I. *Pope*, ascended the papal throne, A. D. 772. He was the son of Theodore, a Roman nobleman, and possessed considerable talents for business. He maintained a steady attachment to Charlemagne, which provoked Desiderius, a king of the Lombards, to invade the state of Ravenna, and to threaten Rome itself. Charlemagne rewarded his attachment, by marching with a great army to his aid; and having gained many considerable advantages over Desiderius, he visited the pope at Rome, and expressed his piety, by the humiliating ceremony of kissing each of the steps, as he ascended to the church of St Peter. The affairs of the church now claimed Adrian's particular attention: for Irene, who, in 780, assumed the regency at Constantinople, during the minority of her son Constantine, wishing to restore the worship of images, applied to Adrian for his concurrence. The pontiff readily acquiesced in her proposal for calling a council, and commissioned two legates to attend it. The first council, however, was dispersed by an insurrection of the citizens; but at the next meeting in the city of Nice, in 787, which was protected by a military force, a decree was passed for restoring the worship of images. Adrian approved the decree, but in the western church it was deemed heretical and dangerous. Charlemagne condemned the innovation, and the French and English clergy concurred in opposing it. A treatise, containing 120 heads of refutation, was circulated, as the work of Charlemagne, under the title of "The Caroline Books," in opposition to the decree of the council. This work was presented to the pope by the king's ambassador, and the pope wrote a letter to Charlemagne by way of reply. The king, and also the Gallican and English churches, retained their sentiments; and, in 794, a council was held at Frankfort on the Maine, consisting of about 300 western bishops, by which every kind of image-worship was condemned. Adrian did not live to see a termination of this contest; for after a pontificate of nearly twenty-four years, he died in 795. Adrian seems to have directed his chief attention to the embellishment of the churches, and the improvement of the city of Rome; and he was probably furnished by Charlemagne, out of the plunder of his conquests, with ample means for this purpose.

ADRIAN II. *Pope*, succeeded Nicholas I. A. D.

867. Having twice refused the dignity, he accepted it in the 76th year of his age, at the united request of the clergy, nobility, and people. The contest for power between the Greek and Latin churches had been very violent some years before his accession to the papal chair.

Adrian, during this contest with the eastern patriarch, was extending his authority over the kings and princes of the west. He employed his whole interest to induce Charles the Bald, who had taken possession of the kingdom of Lorraine, and who had been crowned at Rheims by the archbishop Hincmar, to relinquish it in favour of the emperor; and he even sent legates to the king, after having attempted to engage Hincmar, the clergy, and the nobility, to desert him, ordering him to surrender to the emperor's right. The king was invincible; and the pope was obliged to give up the contest. He also farther interfered in the concerns of princes, by taking Charles's rebellious son Carloman, and the younger Hincmar, bishop of Laon, under the protection of the Roman see. He proceeded in this business so far, that he was under the necessity of submitting without gaining his point. Death terminated his ambitious projects and his life of inquietude, A. D. 872, after a pontificate of five years.

ADRIAN IV. *Pope*, the only Englishman who ever had the honour of sitting in the papal chair. His name was Nicholas Brekespere; and he was born at Langley, near St Alban's, in Hertfordshire. His father having left his family, and taken the habit of the monastery of St Alban's, Nicholas was obliged to submit to the lowest offices in that house for daily support. After some time, he desired to take the habit in that monastery, but was rejected by the abbot Richard. Upon this he resolved to try his fortune in another country, and accordingly went to Paris; where, though in very poor circumstances, he applied himself to his studies with great assiduity, and made a wonderful proficiency. But having still a strong inclination to a religious life, he left Paris, and removed to Provence, where he became a regular clerk in the monastery of St Rufus. He was not immediately allowed to take the habit; but passed some time, by way of trial, in recommending himself to the monks by a strict attention to all their commands. This behaviour, together with the beauty of his person, and prudent conversation, rendered him so acceptable to those religious, that after some time they entreated him to take the habit of the canonical order. Here he distinguished himself so much by his learning and strict observance of the monastic discipline, that upon the death of the abbot, he was chosen superior of that house; and we are told that he rebuilt the convent. Pope Eugenius III. being apprised of the great merit of Nicholas, and thinking he might be serviceable to the church in a higher station, created him cardinal-bishop of Alba in 1146. In 1148, his holiness sent him legate to Denmark and Norway; where, by his fervent preach-
ing

high, and the south one not much less; but the north one was considerably lower. From the dimensions of the ditch, taken as it passes through a lime-stone quarry near Harlow hill, it appears to have been 9 feet deep, and 11 wide at the top, but somewhat narrower at the bottom. The north rampart was about 20 feet distant from the ditch.

Adrian. ing and diligent instructions, he converted those barbarous nations to the Christian faith, and erected Upsal into an archiepiscopal see. When he returned to Rome, he was received by the pope and cardinals with great marks of honour; and Pope Anastasius, who succeeded Eugenius, happening to die at this time, Nicholas was unanimously chosen to the holy see, in November 1154, and he took the name of *Adrian*. When the news of his promotion reached England, King Henry II. sent Robert abbot of St Alban's, and three bishops, to Rome, to congratulate him on his election; upon which occasion Adrian granted very considerable privileges to the monastery of St Alban's, particularly an exemption from all episcopal jurisdiction, excepting to the see of Rome. Adrian, in the beginning of his pontificate, boldly withstood the attempts of the Roman people to recover their ancient liberty under the consuls, and obliged those magistrates to abdicate their authority, and leave the government of the city to the pope. In 1155, he drove the heretic Arnaud of Bresse, and his followers, out of Rome. The same year he excommunicated William king of Sicily, who ravaged the territories of the church, and absolved that prince's subjects from their allegiance. About the same time, Frederick king of the Romans, having entered Italy with a powerful army, Adrian met him near Sutrium, and concluded a peace with him. At this interview, Frederick consented to hold the pope's stirrup whilst he mounted on horseback. After which, his holiness conducted that prince to Rome, and in St Peter's church placed the imperial crown on his head, to the great mortification of the Roman people, who assembled in a tumultuous manner, and killed several of the Imperialists. The next year a reconciliation was brought about between the pope and the Sicilian king, that prince taking an oath to do nothing farther to the prejudice of the church, and Adrian granting him the title of *King of the Two Sicilies*. He built and fortified several castles, and left the papal dominions in a more flourishing condition than he found them. But notwithstanding all his success, he was extremely sensible of the disquietudes attending so high a station; and declared to his countryman John of Salisbury, that all the former hardships of his life were mere amusement to the misfortunes of the popedom; that he looked upon St Peter's chair to be the most uneasy seat in the world; and that his crown seemed to be clapped burning on his head*. He died September 1. 1159, in the fourth year and tenth month of his pontificate; and was buried in St Peter's church, near the tomb of his predecessor Eugenius. There are extant several letters, and some homilies, written by Pope Adrian.

Barbanius
inal. tom.
an.
54:

ADRIAN V. Pope, a Genoese, whose name was Ottoboni Fiesci, succeeded Innocent V. A. D. 1276. He was by his uncle Innocent IV. created cardinal deacon of St Adrian, and in 1254 sent by him to England, to settle the disputes between Henry III. and his barons. He was employed again for the same purpose, by Clement III. when he issued a sentence of excommunication against the king's enemies. When he was congratulated on his accession to the papal chair, he said, "I wish you had found me a healthy cardinal, rather than a dying pope." After his election he went to Viterbo to meet the emperor Rodolphus, for

the purpose of opposing the usurpation of Charles, king of the Two Sicilies; but died soon after his arrival, having enjoyed his dignity only thirty-eight days. He zealously encouraged the crusade to the Holy Land, and upon his election sent a large sum to Constantinople towards building galleys.

**Adrian,
Adriani.**

ADRIAN, cardinal priest, of the title of St Chrysogonus, was a native of Cornetto in Tuscany. Innocent VIII. sent him nuncio into Scotland and into France; and after he had been clerk and treasurer of the apostolic chamber, Pope Alexander VI. whose secretary he had been, honoured him with the cardinal's hat. His life was a continued scene of odd alterations. He narrowly escaped death the day Alexander VI. poisoned himself by mistake. Afterward he drew upon himself the hatred of Julius II. so that he was obliged to go and hide himself in the mountains of Trent. Having been recalled by Leo X. he was so ungrateful, that he engaged in a conspiracy against him. The pope pardoned his fault; but the cardinal, not caring to trust to this, made his escape, and it could never be known exactly what was become of him. He was one of the first who effectually reformed the Latin style. He studied Cicero with great success, and made many excellent observations on the propriety of the Latin tongue. The treatise he composed *De Sermone Latino*, is a proof of this. He had begun a Latin translation of the Old Testament. He wrote *De Vera Philosophia*: This treatise was printed at Cologne, 1548.

ADRIAN VI. Pope. was born at Utrecht in 1459. His father was not able to maintain him at school, but he got a place at Louvain, in a college in which a certain number of scholars were maintained *gratis*. It is reported that he used to read in the night time by the light of the lamps in the churches or streets. He made a considerable progress in all the sciences; led an exemplary life; and there never was a man less intriguing and forward than he was. He took his degree of doctor of divinity at Louvain; was soon after made canon of St Peter's, and professor of divinity at Utrecht, and then dean of St Peter's and vice-chancellor of the university. He was obliged to leave an academical life, to be tutor to the archduke Charles. This young prince made no great progress under him: however, never was a tutor more considerably rewarded; for it was by Charles V.'s credit he was raised to the papal throne. Leo X. had given him the cardinal's hat in 1517. After this pope's death, several cabals in the conclave ended in the election of Adrian, with which the people of Rome were very much displeased. He would not change his name, and in every thing he showed a great dislike for all ostentation and sensual pleasures, though such an aversion had been long ago out of date. He was very partial to Charles V. and did not enjoy much tranquillity under the triple crown. He lamented much the wicked morals of the clergy, and wished to establish a reformation of manners among them. He died September 14. 1523.

ADRIANI, JOANNI BATTISTA, was born of a patrician family of Florence in 1511. He wrote a History of his own Times in Italian; which is a continuation of Guicciardini, beginning at the year 1536; to which Thuanus acknowledges himself greatly indebted; besides which, he composed six funeral orations,

Adriani
||
Adrianum.

tions, on the emperor Charles V. and other noble personages; and is thought to have been the author of a long letter on ancient painters and sculptors, prefixed to the third volume of Vasari. He died at Florence in 1579.

ADRIANISTS, in ecclesiastical history, a sect of heretics divided into two branches, the first were disciples of Simon Magus, and flourished about the year 34. Theodoret is the only person who has preserved their name and memory; but he gives us no account of their origin. Probably this sect, and the six others which sprung from the Simonians, took their name from the particular disciples of Simon. The second were the followers of Adrian Hamstead the anabaptist; and held some particular errors concerning Christ.

ADRIANOPOLE, a city of Turkey in Europe, in the province of Rumania, and the see of an archbishop under the patriarch of Constantinople. It is about seven or eight miles in circumference, including the old city and some gardens. The houses are low, mostly built of mud and clay, and some of brick: and the streets are exceedingly dirty. The walls and towers are in a great measure fallen to decay. However, there is a beautiful bazar, or market, half a mile long, called Ali Bassa. It is a vast arched building, with six gates, and 365 well furnished shops, kept by Turks, Armenians, and Jews, who pay five crowns a-month for each shop. The number of inhabitants of all nations and religions may be about 100,000; but it is dear living here, because the provisions are brought from distant places. The air is wholesome, and the country very pleasant in the summer time, on account of the river and streams that run near and about the city; the chief of which is the Mariza. These promote and preserve the verdure of the gardens, meadows, and fields, for a considerable part of the year. In the winter there is plenty of game. Near the principal bazar there is another, about a mile in length, covered with boards, with holes on each side to let in the light. It is full of good shops, which contain all kinds of commodities. Sultan Seïm's mosque stands on the side of a hill, in the midst of the city; and hence this magnificent structure may be seen on all sides. Every thing made of gold and silver, jewels, pistols, scimitars, &c. are sold in another part of the city, called by travellers the *bizestein*, though it differs little from a bazar. This contains about 200 shops, and is covered like the former: but the covering is supported by two rows of large pillars. The grand vizier's palace is nothing more than a convenient house, after the Turkish manner of building. The emperor's seraglio is a regular structure, in a plain near the river Tungia. It is two miles in compass, and has seven gates, besides those of the gardens, which are several miles in circumference. The city is governed by a mullah cadi, who has an absolute authority both in civil and criminal matters. In the time of the plague, or war, the grand signior sometimes resides here. The Turks took this city from the Greeks in 1362, and made it the capital of empire, till Mahomet II. took Constantinople in 1453. E. Long. 26. 27. N. Lat. 41. 41.

ADRIANUM (or **ADRIATICUM**) MARE, in *Ancient Geography*, now the gulf of Venice, a large bay in the Mediterranean, between Dalmatia, Sclavonia, Greece, and Italy. It is called by the Greeks *Adriaticus*

Κελπος; and *Adria* by the Romans, (as *Arbiter Adriæ Notus*, Hor.) Cicero calls it *Hadrianum Mare*; Virgil has *Hadriaticas Undas*. It is commonly called *Mare Adriaticum* without an aspiration; but whether it ought to have one, is a dispute: if the appellation is from *Hadria*, the town of the Piceni, it must be written *Hadriaticum*, because the emperor's name, who thence derives his origin, is on coins and stones *Hadrianus*; but if from the town in the territory of Venice, as the more ancient, and of which that of the Piceni is a colony, this will justify the common appellation *Adriaticum*.

ADROGATION, in Roman antiquities, a species of adoption, whereby a person who was capable of choosing for himself was admitted by another into the relation of a son. The word is compounded of *ad*, "to," and *rogare*, "to ask;" on account of a question put in the ceremony of it, Whether the adopter would take such a person for his son? and another to the adoptive, Whether he consented to become such a person's son?

ABSIDELLA, in antiquity, the table at which the flames sat during the sacrifices.

ADSTRICITION, among physicians, a term used to denote the rigidity of any part.

ADUACA, or **ATUACA**, anciently a large and famous city of the Tungri; now a small and inconsiderable village, called *Tongerren*, in the bishopric of Liege, to the north-west of the city of Liege, in the territory of Haspengow, on the rivulet Jecker, that soon after falls into the Maese. E. Long. 5. 52. N. Lat. 50. 54.

ADVANCE, in the mercantile style, denotes money paid before goods are delivered, work done, or business performed.

ADVANCED, in a general sense, denotes something posted or situated before another. Thus,

ADVANCED Ditch, in *Fortification*, is that which surrounds the glacis or esplanade of a place.

ADVANCED Guard, or *Vanguard*, in the art of war, the first line or division of an army, ranged or marching in order of battle; or, it is that part which is next the enemy, and marches first towards them.

ADVANCED Guard, is more particularly used for a small party of horse stationed before the main guard.

ADVANCER, among sportsmen, one of the starts or branches of a buck's attire, between the back antler and the palm.

ADUAR, in the Arabian and Moorish customs, a kind of ambulatory village, consisting of tents, which these people remove from one place to another, as suits their convenience.

ADVENT, in the calendar, properly signifies the approach of the feast of the nativity. It includes four Sundays, which begins on St Andrew's day or on the Sunday before or after it. During advent, and to the end of the octaves of epiphany, the solemnizing of marriage is forbidden without a special license. It is appointed to employ the thoughts of Christians on the first advent or coming of Christ in the flesh, and his second advent or coming to judge the world. The primitive Christians practised great austerity during this season.

AD VENTREM INSPICIENDUM, in *Law*, a writ by which a woman is to be searched whether she be with child.

Adrianum
||
Advent.

advent. by a former husband, on her withholding of lands from *venture* the next, failing issue of her own body.

ADVENTURE, in a general sense, some extraordinary or accidental event. It also denotes a hazardous or difficult undertaking.

Bill of ADVENTURE, among merchants, a writing signed by a merchant, testifying the goods mentioned in it to be shipped on board a certain vessel belonging to another person, who is to run all hazards; the merchant only obliging himself to account to him for the produce.

ADVENTURE Bay, in Van Diemen's land. "There is a beautiful sandy beach, about two miles long, at the bottom of Adventure bay, formed to all appearance by the particles which the sea washes from a fine white sand-stone. This beach is very well adapted for hauling a seine. Behind it is a plain, with a brackish lake, out of which we caught, by angling, some bream and trout. The parts adjoining the bay are mostly hilly, and are an entire forest of tall trees, rendered almost impassable by brakes of fern, shrubs, &c. The soil on the flat land, and on the lower part of the hills, is sandy, or consists of a yellowish earth, and in some parts of a reddish clay; but further up the hills, it is of a gray tough cast. This country, upon the whole, bears many marks of being very dry, and the heat appears to be great. No mineral bodies, nor stones of any other kind than the white sand-stone, were observed by us; nor could we find any vegetables that afforded subsistence for man. The forest trees are all of one kind, and generally quite straight: they bear clusters of small white flowers. The principal plants observed, are wood-sorrel, milkwort, cudweed, bell-flower, gladiolus, samphire, and several kinds of fern; the only quadruped, a species of opossum, about twice the size of a large rat. The kangaroo, found further northward in New Holland, may also be supposed to inhabit here, as some of the inhabitants had pieces of the skin of that animal.

"The principal sorts of birds in the woods are brown hawks or eagles, crows, large pigeons, yellowish parrots, and a species which they called *motacilla cyanea*, from the beautiful azure colour of its head and neck. On the shore were several gulls, black oyster-catchers, or sea pies, and plovers of a stone colour.

"The inhabitants seemed mild and cheerful, with little of that wild appearance that savages in general have. They are almost totally devoid of personal activity or genius, and are nearly upon a par with the wretched natives of Terra del Fuego. They display, however, some contrivance in their method of cutting their arms and bodies in lines of different directions, raised above the surface of the skin. Their indifference for presents, their general inattention and want of curiosity, were very remarkable, and testified no acuteness of understanding. Their complexion is a dull black, which they sometimes heighten by smutting their bodies, as was supposed, from their leaving a mark behind on any clean substance. Their hair is perfectly woolly, and is clotted with grease and red ochre, like that of the Hottentots. Their noses are broad and full, and the lower part of the face projects considerably. Their eyes are of a moderate size; and though they are not very quick or piercing, they give the countenance a frank, cheerful, and pleasing cast.

Their teeth are not very white, nor well set, and their mouths are too wide: they wear their beards long, and clotted with paint. They are, upon the whole, well proportioned, though their belly is rather protuberant. Their favourite attitude is to stand with one side forward, and one hand grasping, across the back, the opposite arm, which on this occasion hangs down by the side that projects." *Cook's Voyages*.

ADVENTURER, in a general sense, denotes one who hazards something.

ADVENTURERS, is particularly used for an ancient company of merchants and traders, erected for the discovery of lands, territories, trades, &c. unknown. The society of adventurers had its rise in Burgundy, and its first establishment from John duke of Brabant in 1248, being known by the name of *The brotherhood of St Thomas à Becket*. It was afterwards translated into England, and successively confirmed by Edward III. and IV. Richard III. Henry IV. V. VI. and VII. who gave it the appellation of *Merchant Adventurers*.

ADVERB, in *Grammar*, a particle joined to a verb, adjective, or participle, to explain their manner of acting or suffering; or to mark some circumstance or quality signified by them. The word is formed from the preposition *ad*, "to," and *verbum*, "a verb;" and signifies literally a word joined to a verb, to show how, when, or where, one is, does, or suffers; as, the boy paints *neatly*, writes *ill*; the house stands *there*, &c. See **GRAMMAR**.

ADVERSARIA, among the ancients, a book of accounts, not unlike our journals, or day-books. It is more particularly used for a kind of common-place book. See **COMMON-PLACE BOOK**.

ADVERSATIVE, in *Grammar*, a word expressing some difference between what goes before and what follows it. Thus, in the phrase, *he is an honest man, but a great enthusiast*, the word *but* is an adversative conjunction.

ADVERSATOR, in antiquity, a servant who attended the rich in returning from supper, to give them notice of any obstacles in the way, at which they might be apt to stumble.

ADVERTISEMENT, in a general sense, denotes any information given to persons interested in an affair; and is more particularly used for a brief account of an affair inserted in the public papers, for the information of all concerned.

ADULA, in *Ancient Geography*, a mountain in Rætia, or the country of the Grisons, part of the Alps, in which are the fountains of the Rhine; now *St Gothards*.

ADULE, or **ADULIS**, in *Ancient Geography*, a town of Egypt built by fugitive slaves, distant from its port on the Red sea 20 stadia. Pliny calls the inhabitants *Adulitæ*. The epithet is either *Adulitanus*; as, *Monumentum Adulitanum*, on the pompous inscription of the statue of Ptolemy Euergetes, published by Leo Alatus, at Rome in 1631, and to be found in Spon and Thevenot: or *Adulicus*; as *Adulicus Sinus*, a part of the Red sea.

ADULT, an appellation given to any thing that is arrived at maturity: Thus we say an adult person, an adult plant, &c. Among civilians, it denotes a youth between 14 and 25 years of age.

ADULTERER,

Adventure
||
Adult

Adulterer
||
Adulterine.

ADULTERER, a man who commits adultery. See **ADULTERY**.

ADULTERESS, a woman guilty of **ADULTERY**. An adulteress, by our law, undergoes no temporal punishment whatever, except the loss of her dower; and she does not lose even that, if her husband is weak enough to be reconciled to her, and cohabit with her after the offence committed. 13 Ed. I. cap. 34.

But it is to be observed that adulteresses are such either by the canon or civil law. According to the former, a woman is an adulteress who, either being herself married, converses carnally with another man; or being single herself, converses with a man that is married. According to the latter, she is not an adulteress, if she be not herself in the married state, though she converses with a man that is. The crime, in this case, was more properly called *stuprum* than *adulterium*. Hence, among the Romans the word *adultera*, "adulteress," differed from *pellex*, which denoted a single woman who cohabited with a married man; and *pellex* differed from *concubina*, which signified her who had only intercourse with an unmarried man. The former was reputed infamous, and the other innocent.

ADULTERATION, the act of debasing, by an improper mixture, something that was pure and genuine.

The word is Latin, formed of the verb *adulterare*, "to corrupt," by mingling something foreign to any substance. We have laws against the adulteration of coffee, tea, tobacco, snuff, wine, beer, bread, wax, hairpowder, &c.

ADULTERATION of coin, properly imports the making or casting of a wrong metal, or with too base or too much alloy.

Adulterations of coins are effected divers ways: as, by forging another stamp or inscription; by mixing impure metals with the gold or silver: most properly, by making use of a wrong metal, or an undue alloy, or too great an admixture of the baser metals with gold or silver. Counterfeiting the stamp, or clipping and lessening the weight, do not so properly come under the denomination of *adulterating*. Evelyn gives rules and methods both of *adulterating* and detecting adulterated metals, &c.—*Adulterating* is somewhat less extensive than *debasing*, which includes diminishing, clipping, &c.

To adulterate or debase the current coin, is a capital crime in all nations.—The ancients punished it with great severity: among the Egyptians both hands were cut off: and by the civil law, the offender was thrown to wild beasts. The emperor Tacitus enacted, That counterfeiting the coin should be capital; and under Constantine it was made treason, as it is also among us. The adulterating of gems is a curious art, and the methods of detecting it no less useful. Nichols *Lapid.* p. 18.

ADULTERINE, in the *Civil Law*, is particularly applied to a child issued from an adulterous amour or commerce. Adulterine children are more odious than the illegitimate offspring of single persons.—The Roman law even refuses them the title of natural children; as if nature disowned them. Adulterine children are not easily dispensed with for admission to orders. Those are not deemed adulterine, who are begotten of a woman openly married, through ignorance of a former

wife being alive. By a decree of the parliament of Paris, adulterine children are declared not legitimated by the subsequent marriage of the parties, even though a papal dispensation he had for such marriage, wherein is a clause of legitimation.

ADULTERINE Marriages, in St Augustine's sense, denote second marriages, contracted after a divorce.

ADULTERY, an unlawful commerce between one married person and another, or between a married and unmarried person.

Punishments have been annexed to adultery in most ages and nations, though of different degrees of severity. In many it has been capital: in others venial, and attended only with slight pecuniary mulcts. Some of the penalties are serious, and even cruel; others of a jocose and humorous kind. Even contrary things have been enacted as punishments for adultery. By some laws, the criminals are forbidden marrying together, in case they became single; by others, they are forbidden to marry any besides each other; by some, they are incapacitated from ever committing the like crime again; by others, they are glutted with it till it becomes downright nauseous.

Among the rich Greeks, adulterers were allowed to redeem themselves by a pecuniary fine; the woman's father, in such cases, returned the dower he had received from her husband, which some think was refunded by the adulterer. Another punishment among those people, was putting out the eyes of adulterers.

The Athenians had an extraordinary way of punishing adulterers, called *παράσιμος αναφαροιδωσις*, practised at least on the poorer sort who were not able to pay the fines. This was an awkward sort of empalement, performed by thrusting one of the largest radishes up the anus of the adulterer, or, in defect thereof, a fish with a large head, called *mugil*, "mullet." Alcæus is said to have died this way, though it is doubted whether the punishment was reputed mortal. Juvenal and Catullus speak of this custom as received also among the Romans, though not authorized by an express law as it was among the Greeks.

There are various conjectures concerning the ancient punishment of adultery among the Romans. Some will have it to have been made capital by a law of Romulus, and again by the twelve tables. Others, that it was first made capital by Augustus; and others, not before the emperor Constantine. The truth is, the punishment in the early days was very various, much being left to the discretion of the husband and parents of the adulterous wife, who exercised it differently, rather with the silence and countenance of the magistrate than any formal authority from him. Thus we are told, the wife's father was allowed to kill both parties, when caught in the fact, provided he did it immediately, killed both together, and as it were with one blow. The same power ordinarily was not indulged the husband, except the crime were committed with some mean or infamous person; though, in other cases, if his rage carried him to put them to death, he was not punished as a murderer. On many occasions, however, revenge was not carried so far; but mutilating, castrating, cutting off the ears, noses, &c. served the turn. The punishment allotted by the *lex Julia*, was not, as many have imagined, death; but rather banishment, or deportation, being interdicted fire and water: though

Octavius

Adultery. Octavius appears, in several instances, to have gone beyond his own law, and to have put adulterers to death. Under Macrinus, many were burnt at a stake. Constantine first by law made the crime capital. Under Constantius and Constans, adulterers were burnt, or sewed in sacks and thrown into the sea. Under Leo and Marcian, the penalty was abated to perpetual banishment, or cutting off the nose. Under Justinian, a farther mitigation was granted, at least in favour of the wife, who was only to be scourged, lose her dower, and be shut up in a monastery; after two years, the husband was at liberty to take her back again; if he refused, she was shaven, and made a nun for life: But it still remained death in the husband. The reason alleged for this difference is, that the woman is the weaker vessel. Matthæus declaims against the empress Theodora, who is supposed to have been the cause of this law, as well as of others procured in favour of that sex from the emperor.

Under Theodosius, women convicted of this crime were punished after a very singular manner, viz. by a public constupration; being locked up in a narrow cell, and forced to admit to their embraces all the men that would offer themselves. To this end, the gallants were to dress themselves on purpose, having several little bells fastened to their clothes, the tinkling of which gave notice to those without of every motion. This custom was again abolished by the same prince.

By the Jewish law, adultery was punished by death in both parties, where they were both married, or only the woman. The Jews had a particular method of trying, or rather purging, an adulteress, or a woman suspected of the crime, by making her drink the bitter waters of jealousy; which, if she were guilty, made her swell.

Amongst the Mingrelians, according to Chardin, adultery is punished with the forfeiture of a hog, which is usually eaten in good friendship between the gallant, the adulteress, and the cuckold. In some parts of the Indies, it is said any man's wife is permitted to prostitute herself to him who will give an elephant for the use of her; and it is reputed no small glory to her to have been rated so high. Adultery is said to be so frequent in Ceylon, that not a woman but practises it, notwithstanding its being punishable with death. Among the Japanese, and divers other nations, adultery is only penal in the woman. Among the Abyssinians, the crime of the husband is said to be only punished on the innocent wife. In the Marian islands, on the contrary, the woman is not punishable for adultery; but if the man go astray he pays severely: the wife and her relations waste his lands, turn him out of his house, &c. Among the Chinese, there is reason to conclude that adultery is not capital; for it is said that fond parents will make a contract with their daughters future husbands to allow them the indulgence of a gallant.

In Spain, they punished adultery in men by cutting off that part which had been the instrument of the crime. In Poland, before Christianity was established, they punished adultery and fornication in a very particular manner: the criminal they carried to the market-place, and there fastened him by the testicles with a nail; laying a razor within his reach, and leaving him under a necessity, either of doing justice upon himself, or of perishing in that condition.

The Saxons formerly burnt the adulteress, and over her ashes erected a gibbet, whereon the adulterer was hanged. In this kingdom, likewise, adultery, by the ancient laws, was severely punished. King Edmund the Saxon ordered adultery to be punished in the same manner as homicide; and Canute the Dane ordered that a man who committed adultery should be banished, and that the woman should have her nose and ears cut off. In the time of Henry I. it was punished with the loss of eyes and genitals.

In Britain, adultery is reckoned a spiritual offence, that is, cognizable by the spiritual courts, where it is punished by fine and penance. The common law takes no farther notice of it, than to allow the party grieved an action and damages. This practice is often censured by foreigners, as making too light of a crime, the bad consequences of which, public as well as private, are so great. It has been answered, that perhaps this penalty, by civil action, is more wisely calculated to prevent the frequency of the offence, which ought to be the end of all laws, than a severer punishment. He that by a judgement of law is, according to circumstances, stripped of great part of his fortune, thrown into prison till he can pay it, or forced to fly his country, will, no doubt, in most cases, own that he pays dearly for his amusement.

As to the moral turpitude of this offence, some have vainly endeavoured to deny or explain it away by various arguments, and even by an appeal to Scripture. On the part of the *man* who solicits the chastity of a married woman, it certainly includes the crime of SEDUCTION, and is attended with mischief still more complicated and extensive: It creates a new sufferer, the injured husband, upon whose simplicity and affection is inflicted a wound the most painful and incurable that human nature knows. The infidelity of the *woman* is aggravated by cruelty to her children, who are generally involved in their parents shame, and always made unhappy by their quarrel.

It has been argued, that these consequences ought less to be attributed to the crime than to the discovery. But, in the first place, the crime could not be discovered unless it were committed, and the commission is never secure from discovery. 2dly, If adulterous connections were allowable whenever the parties could hope to escape detection, which is the conclusion to which this argument leads, the husband would be left no other security for his wife's chastity, than in her want of opportunity or temptation; which would probably deter most men from marrying; or render marriage a state of continual jealousy and alarm to the husband, which would end in the slavery and confinement of the wife.

The marriage vow is "witnessed before God," and accompanied with circumstances of solemnity and religion which approach to the nature of an oath. The married offender, therefore, incurs a crime little short of perjury, and the seduction of a married woman is little less than subornation of perjury:—and this guilt is independent of the discovery.

But the usual apology for adultery is the prior transgression of the other party; and so far indeed, as the bad effects of adultery are anticipated by the conduct of the husband or wife who offends first, the guilt of the second offender is extenuated. But this can never

amount

Adultery. amount to a justification ; unless it could be shown that the obligation of the marriage vow depends upon the condition of reciprocal fidelity ; a construction which appears founded neither in expediency, nor in the terms of the vow, nor in the design of the legislature which prescribed the marriage rite. The way of considering the offence upon the footing of *provocation and retaliation*, is a childish trifling with words.

"Thou shalt not commit adultery," was an interdict delivered by God himself ; yet Scripture has been adduced as giving countenance to the crime. As Christ told the woman taken in adultery, "Neither do I condemn thee," we must believe, it is said, that he deemed her conduct either not criminal, or at least not a crime of the heinous nature we represent it to be. But from a more attentive examination of the case, it will be evident that nothing can be concluded from it favourable to such an opinion. The transaction is thus related :

* *St John's Gospel*, chap. viii.

"Early in the morning Jesus came again into the temple, and all the people came unto him ; and he sat down and taught them. And the Scribes and Pharisees brought unto him a woman taken in adultery ; and when they had set her in the midst, they say unto him, Master, this woman was taken in adultery in the very act. Now Moses in the law commanded us that such should be stoned, but what sayest thou ? This they said, tempting him, that they might have to accuse him. But Jesus stooped down, and with his finger wrote on the ground, as though he heard them not. So when they continued asking him, he lifted up himself, and said unto them, He that is without sin amongst you, let him first cast a stone at her ; and again he stooped down and wrote on the ground : and they which heard it, being convicted by their own conscience, went out one by one, beginning at the eldest, even unto the last ; and Jesus was left alone, and the woman standing in the midst. When Jesus had lifted up himself, and saw none but the woman, he said unto her, Woman, where are those thine accusers ! Hath no man condemned thee ? She said, No man, Lord : and Jesus said unto her, *Neither do I condemn thee ; go and sin no more.*"

"This they said, tempting him, that they might have to accuse him ;" that is, to draw him into an exercise of judicial authority, that they might have to accuse him before the Roman governor of usurping or intermeddling with the civil government.

Palley's Moral and Political Philosophy, p. 258, 3d edit. 4to.

"This was their design ; and Christ's behaviour throughout the whole affair proceeded from a knowledge of this design, and a determination to defeat it. He gives them at first a cold and sullen reception, well suited to the insidious intention with which they came : he stooped down, and with his finger wrote on the ground as though he heard them not." "When they continued asking him," when they teased him to speak, he dismissed them with a rebuke, which the impertinent malice of their errand, as well as the secret character of many of them, deserved : "he that is without sin (that is, this sin) among you, let him first cast a stone at her." This had its effect. Stung with the reproof, and disappointed of their aim, they stole away one by one, and left Jesus and the woman alone. And then follows the conversation, which is the part of the narrative most material to our present

subject. "Jesus saith unto her, Woman, where are those thine accusers ? Hath no man condemned thee ?" "She said, No man, Lord. And Jesus said unto her, 'Neither do I condemn thee ; go and sin no more.' Now, when Christ asked the woman, 'Hath no man condemned thee ?' he certainly spoke, and was understood by the woman to speak, of a legal and judicial condemnation ; otherwise her answer, 'No man, Lord,' was not true. In every other sense of condemnation, as blame, censure, reproof, private judgment, and the like, many had condemned her ; all those, indeed, who brought her to Jesus. If then a judicial sentence was what Christ meant by *condemning* in the question, the common use of language requires us to suppose that he meant the same in his reply 'Neither do I condemn thee :' i. e. I pretend to no judicial character or authority over thee ; it is no office or business of mine to pronounce or execute the sentence of the law. When Christ adds, 'Go and sin no more,' he in effect tells her that she had sinned already ; but as to the degree or quality of the sin, or Christ's opinion concerning it, nothing is declared, or can be inferred, either way."

It has been controverted, whether adultery may be lawfully committed in war, with the enemies wives ? The answer is in the negative, and the authorized practice of civilized nations is agreeable to this. It has also been a famous question, whether it be lawful for a woman to commit adultery with the consent of her husband, and for the procuring some great good to him ? St Austin apparently allows of it ; at least does not condemn it *.

It has likewise been a dispute, whether it be lawful for one of the parties married to commit adultery with the consent of the other, for the sake of having children ? Of which we have instances in Abraham, who, on this account, conversed with Hagar ; and likewise among the Greeks and Romans. Pollman, a German professor, has a dissertation on the husband's right to alienate his wife's body to another's use.

It is much disputed, whether adultery dissolves the bond of matrimony, and be a sufficient cause of divorce, so that the parties may marry again. This was allowed in the ancient church, and is still continued in the Greek, as well as the Lutheran and Calvinist churches. Romanists, however, disallow of it, and the council of Trent even anathematized those who maintain it ; though the canon of anathematization was mitigated in deference to the republic of Venice, in some of whose dominions, as Zant, Cephalonia, &c. the contrary usage obtains. The ecclesiastical courts in England so far agree with the Papists, that they only grant a divorce *à mensa et thoro*, in case of adultery ; so that a complete divorce to enable the parties to marry again, cannot be had without an act of parliament.

ADULTERY is also used in ancient customs, for the punishment or fine imposed for that offence, or the privilege of prosecuting for it. In which sense *adulterium* amounts to the same with what the Saxons call *legerwita*.

ADULTERY is sometimes used in a more extensive sense, for any species of impurity or crime against the virtue of chastity ; and in this sense divines understand the seventh commandment.

ADULTERY

* *De Serm. Dom. in Mont. lib. i. cap. 16. § 49. et De Civ. Dei. lib. xvi. cap. 25.*

ADULTERY is also used, especially in Scripture, for idolatry, or departing from the true God to the worship of a false one.

ADULTERY is also used, in ecclesiastical writers, for a person's invading or intruding into a bishopric during the former bishop's life. The reason of the appellation is, that a bishop is supposed to contract a kind of spiritual marriage with his church. The translation of a bishop from one see to another was also reputed a species of adultery; on the supposition of its being a kind of second marriage, which, in those days, was esteemed a degree of adultery. This conclusion was founded on the text of St Paul, *Let a bishop be the husband of one wife*, by a forced construction of church for wife, and of bishop for husband. (Du Cange).

ADULTERY is also used by ancient naturalists, for the act of ingrafting one plant upon another. In which sense, Pliny speaks of the adulteries of trees, *arborum adulteria*, which he represents as contrary to nature, and a piece of luxury or needless refinement.

ADVOCATE, among the Romans, a person skilled in their law, who undertook the defence of causes at the bar. The Roman advocates answered to one part of the office of a barrister in England, viz. the pleading part; for they never gave counsel, that being the business of the *jurisconsulti*.

The Romans, in the first ages of their state, held the profession of an advocate in great honour; and the seats of their bar were crowded with senators and consuls; they, whose voices commanded the people, thinking it an honour to be employed in defending them. They were styled *comites*, *honorati*, *clarissimi*, and even *patroni*; as if their clients were not less obliged to them than freed men to their masters. The bar was not at that time venal. Those who aspired to honours and offices took this way of gaining an interest in the people, and always pleaded *gratis*. But no sooner were luxury and corruption introduced into the commonwealth, than the bar became a sharer in them. Then it was that the senators let out their voices for pay, and zeal and eloquence were sold to the highest bidder. To put a stop to this abuse, the tribune Cincius procured a law to be passed, called from him *Lex Cincia*, whereby the advocates were forbid to take any money of their clients. It had before this been prohibited the advocates to take any presents or gratuities for their pleading. The emperor Augustus added a penalty to it: notwithstanding which, the advocates played their part so well, that the emperor Claudius thought it an extraordinary circumstance, when he obliged them not to take above eight great sesterces, which are equivalent to about 64l. sterling, for pleading each cause.

ADVOCATE is still used in countries and courts where the civil law obtains, for those who plead and defend the causes of clients trusted to them.

ADVOCATE of a city, in the German polity, a magistrate appointed in the emperor's name to administer justice.

ADVOCATE is more particularly used in church history, for a person appointed to defend the rights and revenues of a church or religious house. The word *advocatus* or *advowee*, is still retained for what we usually call the *patron*, or he who has the advowson, or right of presentation in his own name.

Consistorial ADVOCATES; officers of the consistory at Rome who plead in all oppositions to the disposal of benefices in that court: they are ten in number.

Elective ADVOCATES, those chosen by the abbot, bishop, or chapter; a particular license being had from the king or prince for that purpose. The elections were originally made in the presence of the count of the province.

Feudal ADVOCATES. These were of the military kind, who, to make them more zealous for the interest of the church, had lands granted them in fee, which they held of the church, and did homage, and took an oath of fidelity to the bishop or abbot. These were to lead the vassals of the church to war, not only in private quarrels of the church itself, but in military expeditions for the king's service, in which they were the standard-bearers of their churches.

Fiscal ADVOCATE, *fisci advocatus*, in Roman antiquity, an officer of state under the Roman emperors, who pleaded in all causes wherein the *fiscus*, or private treasury, was concerned.

Juridical ADVOCATES, in the middle age, were those who from attending causes in the court of the *comes*, or count of the province, became judges themselves, and held courts of their vassals thrice a-year, under the name of the *tria placita generalia*. In consideration of this further service, they had a particular allowance of one-third part of all fines, or mulcts, imposed on defaulters, &c. besides a proportion of diet for themselves and servants.

Matricular ADVOCATES, were the advocates of the mother or cathedral churches.

Military ADVOCATES, those appointed for the defence of the church, rather by arms and authority than by pleading and eloquence. These were introduced in the times of confusion, when every person was obliged to maintain his own property by force; bishops and abbots not being permitted to bear arms, and the scholastic or gowned advocates being equally unacquainted with them, recourse was had to knights, noblemen, soldiers, or even to princes.

Nominative ADVOCATES, those appointed by a king or pope. Sometimes the churches petitioned kings, &c. to appoint them an advocate: at other times this was done of their own accord. By some regulations, no person was capable of being elected advocate, unless he had an estate in land in the same county.

Regular ADVOCATES, those duly formed and qualified for their profession, by a proper course of study, the requisite oath, subscription, license, &c.

Subordinate ADVOCATES, those appointed by other superior ones, acting under them, and accountable to them. There are various reasons for the creation of these subordinate advocates; as, the superior quality of the principal advocate, his being detained in war, or being involved in other affairs; but chiefly the too great distance of some of the church lands, and their lying in the dominions of foreign princes.

Supreme Sovereign ADVOCATES, were those who had the authority in chief; but acted by deputies or subordinate advocates. These were called also *principal*, *greater*, and sometimes *general* advocates. Such in many cases were kings, &c. when either they had been chosen advocates, or became such by being founders or endowers of churches. Princes had also another

Advocate,
Advoca-
tion.

another title to advocateship, some of them pretending to be *advocati nati* of the churches within their dominions.

ADVOCATES, in the English courts, are more generally called *counsel*. See COUNSEL.

Faculty of ADVOCATES, in Scotland, a respectable body of lawyers, who plead in all causes before the courts of session, justiciary, and exchequer. They are also entitled to plead in the house of peers, and other supreme courts in England.

In the year 1660, the faculty founded a library upon a very extensive plan, suggested by that learned and eminent lawyer Sir George Mackenzie of Rosehaugh, advocate to King Charles II. and King James VII. who enriched it with many valuable books. It has been daily increasing since that time, and now contains not only the best collection of law books in Europe, but a very large and select collection of books in all subjects. Besides, this library contains a great number of original manuscripts, and a vast variety of Jewish, Grecian, Roman, Scots, and English coins and medals.

A candidate for the office of an advocate undergoes three several trials: The first is in Latin, upon the civil law and Greek and Roman antiquities; the second, in English, upon the municipal law of Scotland; and, in the third, he is obliged to defend a Latin thesis, which is impugned by three members of the faculty. Immediately before putting on the gown, the candidate makes a short Latin speech to the lords, and then takes the oaths to the government and *de fide*.

The faculty at present consists of above 200 members. As an advocate or lawyer is esteemed the gentlest profession in Scotland, many gentlemen of fortune take the degree of advocate, without having any intention of practising at the bar. This circumstance greatly increases their number, gives dignity to the profession, and enriches their library and public fund. It is from this respectable body that all vacancies on the bench are generally supplied.

LORD ADVOCATE, or *King's ADVOCATE*, one of the eight great officers of state in Scotland, who as such sat in parliament without election. He is the principal crown lawyer in Scotland. His business is to act as a public prosecutor, and to plead in all causes that concern the crown; but particularly in such as are of a criminal nature. The office of king's advocate is not very ancient: It seems to have been established about the beginning of the 16th century. Originally he had no power to prosecute crimes without the concurrence of a private party; but, in the year 1597, he was empowered to prosecute crimes at his own instance. He has the privilege of pleading in court with his hat on. This privilege was first granted to Sir Thomas Hope; who having three sons lords of session, it was thought indecent that the father should plead uncovered before the sons, who as judges sat covered.

BILL OF ADVOCATION, in *Scots Law*, a writing drawn up in the form of a petition; whereby a party, in an action before an inferior court, applies to the supreme court, or court of session, for calling the action from the inferior court before itself.

Letters of ADVOCATION, in *Scots Law*, the decree or warrant of the court of session upon cognizance of the

facts set forth in the bill, drawn up in the form of a summons, and passing under the signet, discharging the inferior judge and all others from further procedure in the cause, and advocating it to itself.

ADVOWEE, in ancient customs and law books, denotes the advocate of a church, religious house, or the like. There were advowees of cathedrals, abbeys, monasteries, &c. Thus, Charlemagne had the title of advowee of St Peter's; King Hugh, of St Riquier: and Bolandus mentions some letters of Pope Nicholas, by which he constituted King Edward the Confessor, and his successors, advowees of the monastery at Westminster, and of all the churches in England. These advowees were the guardians, protectors, and administrators of the temporal concerns of the churches, &c. and under their authority were passed all contracts which related to them. It appears also, from the most ancient charters, that the donations made to churches were conferred on the persons of the advowees. They always pleaded the causes of the churches in court, and distributed justice for them, in the places under their jurisdiction. They also commanded the forces furnished by their monasteries, &c. for the war; and even were their champions, and sometimes maintained duels for them.

This office is said to have been first introduced in the fourth century, in the time of Stilico; though the Benedictines do not fix its origin before the eighth century. By degrees, men of the first rank were brought into it, as it was found necessary either to defend with arms or to protect with power and authority. In some monasteries they were only called *conservators*; but these, without the name, had all the functions of advowees. There were also sometimes several sub-advowees, or sub-advocates, in each monastery, who officiated instead of the advowees themselves; which, however, proved the ruin of monasteries; those inferior officers running into great abuses.

Hence also, husbands, tutors, and every person in general, who took upon him the defence of another, were denominated *advowees*, or advocates. Hence several cities had their advowees; which were established long after the ecclesiastical ones, and doubtless from their example. Thus we read in history of the advowees of Augsburg, of Arras, &c.

The *vidames* assumed the quality of advowees; and hence it is, that several historians of the eighth century confound the two functions together. Hence also it is, that several secular lords in Germany bear mitres for their crests, as having anciently been advowees of the great churches.

Spelman distinguishes two kinds of ecclesiastical advowees.—The one, of causes or processes, *advocati causarum*; the other, of territory or lands, *advocati soli*. The former were nominated by the king, and were usually lawyers, who undertook to plead the causes of the monasteries. The other, which still subsist, and are sometimes called by their primitive name, *advowees*, though more usually *patrons*, were hereditary; as being the founders and endowers of churches, &c. or their heirs.

Women were sometimes advowees, *advocatissæ*. And, in effect, the canon law mentions some who had this title, and who had the same right of presentation, &c. in their churches which the advowees themselves had.

advowee In a stat. 25 Edw. III. we meet with *advowee paramount* for the highest patron; that is, the king.

advowson, or *advowzen*, in *Common Law*, signifies a right to present to a vacant benefice. *Advowson* is so called, because the right of presenting to the church was first gained by such as were founders, benefactors, or maintainers of the church.

Though the nomination of fit persons to officiate in every diocese was originally in the bishop, yet they were content to let the founders of churches have the nomination of the persons to the churches so founded, reserving to themselves a right to judge of the fitness of the persons nominated.

Advowsons formerly were most of them appendant to manors, and the patrons were parochial barons: the lordship of the manor and patronage of the church were seldom in different hands, until *advowsons* were given to religious houses. But of late times the lordship of the manor and *advowson* of the church have been divided.

Advowsons are *presentative*, *collative*, or *donative*: *presentative*, where the patron presents or offers his clerk to the bishop of the diocese, to be instituted in his church; *collative*, where the benefice is given by the bishop, as original patron thereof, or by means of a right he has acquired by lapse; *donative*, as where the king or other patron does, by a single donation in writing, put the clerk into possession, without presentation, institution, or induction.

Sometimes, anciently, the patron had the sole nomination of the prelate, abbot, or prior; either by investiture (*i. e.* delivery of a pastoral staff), or by direct presentation to the diocesan; and if a free election was left to the religious, yet a *congé d'elire*, or license of election, was first to be obtained of the patron, and the person elected was confirmed by him. If the founder's family became extinct, the patronage of the convent went to the lord of the manor. Unless the several colleges in the universities be restrained in the number of *advowsons* they may receive, it is argued they will in time acquire such a stock as to frustrate the design of their foundation (which is the education of youth), by creating too quick a succession of fellows; so that there will not be in the colleges a sufficient number of persons of competent age, knowledge, and experience, to instruct and form the minds of the youth. In some colleges the number of *advowsons* is said to be already two-thirds, or more, of the number of fellows. It is objected, on the other side, that the succession of fellows may be too slow as well as too quick; whereby persons well qualified may be detained so long in colleges as not to have strength or activity enough left for the discharge of parochial functions.

Colleges holding more *advowsons* in number than a moiety of the fellows, are not capable of purchasing more. Grants of *advowsons* by Papists are void. 9 Geo. II. c. 36. § 5. 11 Geo. II. c. 17. § 5.

Advowsons are temporal inheritances and lay fees; they may be granted by deed or will, and are assets in the hands of heirs or executors. Presentations to *advowsons* for money, or other reward, are void. 31 Eliz. cap. 6.

In Scotland, this right is called *patronage*. See *PATRONAGE*.

ADUST, *ADUSTUS*, among physicians, &c. is ap-

plied to such humours as by long heat become of a hot and fiery nature. Such is choler supposed to be. Melancholy is usually considered as black and adust bile. Blood is said to be adust, when, by reason of some extraordinary heat, its more subtle parts are all evaporated, leaving the grosser, with all the impurities therein, half torrified.

ADY, in *Natural History*, a name given to the palm tree of the island of St Thomas. It is a tall tree with a thick, bare, upright stem, growing single on its root, of a thin light timber, and full of juice. The head of this tree shoots into a vast number of branches, which being cut off, or an incision being made therein, afford a great quantity of sweet juice, which fermenting supplies the place of wine among the Indians. The fruit of this tree is called by the Portuguese *caryoces* and *cariosse*; and by the black natives, *abanga*. This fruit is of the size and shape of a lemon; and contains a kernel, which is good to eat. The fruit itself is eaten roasted, and the raw kernels are often mixed with mandioc meal. These kernels are supposed very cordial. An oil is also prepared from this fruit, which answers the purpose of oil or butter. This oil is also used for anointing stiff and contracted parts of the body.

ADYNAMIA, in *Medicine*, of a privative, and *δυναμις* strength, want of power, debility, or weakness, from sickness.

ADYNAMIÆ, the second class of Dr Cullen's nosological arrangement, which includes those diseases in which the involuntary motions, whether vital or natural, are diminished.

ADYNAMON, among ancient physicians, a kind of weak factitious wine, prepared from must boiled down with water; to be given to patients to whom genuine wine might be hurtful.

ADYTUM, in Pagan antiquity, the most retired and sacred place of temples, into which none but the priests were allowed to enter. The *Sanctum Sanctorum* of the temple of Solomon was of the nature of the pagan adytum, none but the high priest being admitted into it, and he but once a-year.

ADZE, or *ADDICE*, a cutting tool of the axe kind; having its blade made thin and arching, and its edge at right angles to the handle; chiefly used for taking off thin chips of timber or boards, and for paring away certain irregularities which the axe cannot come at. The adze is used by carpenters, but more by coopers, as being convenient for cutting the hollow sides of boards, &c. It is ground from a base on its inside to its outer edge; so that, when it is blunt, they cannot conveniently grind it without taking its helve out of the eye.

Æ, or *Æ*, a diphthong compounded of *A* and *E*. Authors are by no means agreed as to the use of the *æ* in English words. Some, out of regard to etymology, insist on its being retained in all words, particularly technical ones, borrowed from the Greek and Latin; while others, from a consideration that it is no proper diphthong in our language, its sound being no other than that of the simple *e*, contend that it ought to be entirely disused; and, in fact, the simple *e* has of late been adopted instead of the Roman *æ*, as in the word *equator*, &c.

ÆACEA, in Grecian antiquity, solemn festivals and games celebrated at *Ægina*, in honour of *Æacus*.

ÆACUS, the son of Jupiter by *Ægina*. When

Adust
||
Æacus.

Æacus
||
Ædile.

the isle of Ægina was depopulated by a plague, his father, in compassion to his grief, changed all the ants upon it into men and women, who were called *Myrmidones*, from *μυρμηξ*, an ant. The foundation of the fable is said to be, that when the country had been depopulated by pirates, who forced the few that remained to take shelter in caves, Æacus encouraged them to come out, and by commerce and industry recover what they had lost. His character for justice was such, that, in a time of universal drought, he was nominated by the Delphic oracle to intercede for Greece, and his prayer was answered. See the article ÆGINA. The Pagans also imagined that Æacus, on account of his impartial justice, was chosen by Pluto one of the three judges of the dead; and that it was his province to judge the Europeans.

ÆBUDÆ, a name anciently given to the Western islands of Scotland.

ÆBURA, in *Ancient Geography*, a town of Spain, in Estremadura, on the river Guadiana, to the west of Merida; now called *Talavera*. W. Long. 7. 15. N. Lat. 38. 40.

ÆCHMALOTARCHA, in Jewish antiquity, a title given to the principal leader or governor of the Hebrew captives residing in Chaldea, Assyria, and the neighbouring countries. This magistrate was called by the Jews, *rosch-galath*, i. e. the chief of the captivity: but the above term, of like import in the Greek, is that used by Origen and others who wrote in the Greek tongue.

The Jewish writers assure us, that the *æchmalotarchæ* were only to be chosen out of the tribe of Judah. The eastern Jews had their princes of the captivity, as the western Jews their patriarchs. The Jews are still said to have an *æchmalotarcha* at Babylon, but without the authority of the ancient ones. (*Basnage Hist. Jews*, and *Prideaux's Connection*).

ÆCIDIUM, in *Botany*. See BOTANY Index.

ÆCULANUM, in *Ancient Geography*, a town of the Hirpini in Italy, at the foot of the Apennines, to the east of Abellinum, contracted *Æclanum*, situated between Beneventum and Tarentum. The inhabitants are called *Æculani* by Pliny; and *Æclanenses*, in an ancient inscription (Gruter). The town is now called *Fricento*, (Cluverius), 43 miles east of Naples. E. Long. 15. 38. N. Lat. 41. 15.

ÆDES, in Roman antiquity, besides its more ordinary signification of a house, likewise signified an inferior kind of temple, consecrated to some deity.

ÆDICULA, a term used to denote the inner part of the temple, where the altar and statue of the deity stood.

ÆDILATE, the office of ædile, sometimes called *Ædilitas*. See the next article.

ÆDILE (*ædilis*), in Roman antiquity, a magistrate whose chief business was to superintend buildings of all kinds, but more especially public ones, as temples, aqueducts, bridges, &c. To the ædiles likewise belonged the care of the highways, public places, weights and measures, &c. They also fixed the prices of provisions, took cognizance of debauches, punished lewd women, and such persons as frequented gaming houses. The custody of the plebiscita, or orders of the people, was likewise committed to them. They had the inspection of comedies and other pieces of wit; and were

obliged to exhibit magnificent games to the people, at their own expence, whereby many of them were ruined. To them also belonged the custody of the plebiscita, and the censure and examination of books. They had the power, on certain occasions, of issuing edicts; and, by degrees, they procured to themselves a considerable jurisdiction, the cognizance of various causes, &c. This office ruined numbers by its expensiveness; so that, in Augustus's time, even many senators declined it on that account.

All these functions which rendered the ædiles so considerable belonged at first to the ædiles of the people, *ædiles plebei*, or *minores*: these were only two in number, and were first created in the same year as the tribunes; for the tribunes, finding themselves oppressed with the multiplicity of affairs, demanded of the senate to have officers, to whom they might intrust matters of less importance; and accordingly two ædiles were created; and hence it was that the ædiles were elected every year at the same assembly as the tribunes. But these plebeian ædiles having refused, on a signal occasion, to treat the people with shows, as pleading themselves unable to support the expence thereof, the patricians made an offer to do it, provided they would admit them to the honours of the *ædilate*. On this occasion there were two new ædiles created, of the number of the patricians, in the year of Rome 388; they were called *ædiles curules*, or *maiores*; as having a right to sit on a curule chair, enriched with ivory, when they gave audience; whereas the plebeian ædiles only sat on benches.—Besides that the curule ædiles shared all the ordinary functions with the plebeian, their chief employ was, to procure the celebration of the grand Roman games, and to exhibit comedies, shows of gladiators, &c. to the people; and they were also appointed judges in all cases relating to the selling or exchanging estates.

To ease these four first ædiles, Cæsar created a new kind, called *ædiles cereales*, as being deputed chiefly to take care of the corn, which was called *donum Cereris*; for the Heathens honoured Ceres as the goddess who presided over corn, and attributed to her the invention of agriculture. These ædiles cereales were also taken out of the order of patricians. In the municipal cities there were ædiles, and with the same authority as at Rome.

We also read of an *ædilis alimentarius*, expressed in abbreviation by *Ædil. alim.* whose business seems to have been to provide diet for those who were maintained at the public charge, though others assign him a different office.—In an ancient inscription we also meet with *ædile* of the camp, *ædilis castrorum*.

ÆDILITIUM EDICTUM, among the Romans, was that whereby a remedy was given to a buyer in case a vicious or unsound beast, or slave, was sold to him. It was called *ædilitium*, because the preventing of frauds in sales and contracts belonged especially to the curule ædiles.

ÆDITUUS, in Roman antiquity, an officer belonging to the temple, who had the charge of the offerings, treasure, and sacred utensils. The female deities had a female officer of this kind called *Æditua*.

ÆGAGROPILA, a ball composed of hair, generated in the stomach of the chamois goat, which is similar to those found in cows, hogs, &c. There is another

Ædile
||
Ægagropila.

Agagropila another species of ball found in some animals, particularly horses, which is a calculous concretion.

ÆGÆ, or *ÆGÆA*, in *Ancient Geography*, the name of *Ædessa*, so called from the following adventure: Caranus, the first king of Macedonia, being ordered by the oracle to seek out a settlement in Macedonia, under the conduct of a flock of goats, surprised the town of *Ædessa*, during a thick fog and rainy weather, in following the goats that fled from the rain; which goats ever after, in all his military expeditions, he caused to precede his standard; and in memory of this he called *Ædessa Ægea*, and his people *Ægeadæ*. And hence probably, in the prophet Daniel, the he-goat is the symbol of the king of Macedon.

ÆGEAN SEA, in *Ancient Geography*, now the *Archipelago*, a part of the Mediterranean, separating Europe from Asia; washing, on the one hand, Greece and Macedonia; on the other, Caria and Ionia. The origin of the name is greatly disputed. Festus advances three opinions: one, that it is so called from the many islands therein, at a distance appearing like so many goats: another, because *Ægea* queen of the Amazons perished in it: a third opinion is, because *Ægeus*, the father of Theseus, threw himself headlong into it.

ÆGEUS, in fabulous history, was king of Athens, and the father of Theseus. The Athenians having basely killed the son of Minos king of Crete, for carrying away the prize from them, Minos made war upon the Athenians; and being victorious, imposed this severe condition on *Ægeus*, that he should annually send into Crete seven of the noblest of the Athenian youths, chosen by lot, to be devoured by the Minotaur. On the fourth year of this tribute, the choice fell on Theseus; or, as others say, he himself entreated to be sent. The king, at his son's departure, gave orders, that as the ship sailed with black sails, it should return with the same in case he perished; but, if he became victorious, he should change them into white. When Theseus returned to Crete, after killing the Minotaur, and forgot to change the sails in token of his victory, according to the agreement with his father; the latter, who watched the return of the vessel, supposing by the black sails that his son was dead, cast himself headlong into the sea, which afterwards obtained the name of the *Ægean sea*. The Athenians decreed *Ægeus* divine honours; and sacrificed to him as a marine deity, the adopted son of Neptune.

ÆGIAS, among physicians, a white speck on the pupil of the eye, which occasions a dimness of sight.

ÆGIDA, (Pliny); now *Capo d' Istria*, the principal town on the north of the territory of Istria, situated in a little island, joined to the land by a bridge. In an inscription, (Gruter), it is called *Ægidis Insula*. E. Long. 14. 20. N. Lat. 45. 50. It was afterwards called *Justinopolis*, after the emperor Justinus.

ÆGILOPS, the name of a tumour in the great angle of the eye; either with, or without, an inflammation. The word is compounded of *aiξ* goat, and *ὤφθαλμος* eye; as goats are supposed extremely liable to this distemper.

Authors frequently use the words *ægilops*, *anchilops*, and *fistula lachrymalis*, promiscuously; but the more accurate, after *Ægineta*, make a difference.—The tumour, before it becomes ulcerous, is properly called

anchilops; and, after it is got into the lachrymal passages, and has rendered the os lachrymale carious, *fistula lachrymalis*.

If the *ægilops* be accompanied with an inflammation, it is supposed to take its rise from the abundance of blood which a plethoric habit discharges on the corner of the eye. If it be without an inflammation, it is supposed to proceed from a viscons pituitous humour, thrown upon this part.

The method of cure is the same as that of the ophthalmia. But before it has reached the lachrymal passages, it is managed like other ulcers. If the *ægilops* be neglected, it bursts, and degenerates into a fistula, which eats into the bone.

ÆGILOPS, in *Botany*. See *BOTANY Index*.

ÆGIMURUS, in *Ancient Geography*, an island in the bay of Carthage, about 30 miles distant from that city, (Livy); now the *Goletta*: This island being afterwards sunk in the sea, two of its rocks remained above water, which were called *Aræ*, and mentioned by Virgil, because the Romans and Carthaginians entered into an agreement or league to limit their respective boundaries by these rocks.

ÆGINA, in fabulous history, the daughter of *Æsopus*, king of Bœotia, was beloved by Jupiter, who debauched her in the similitude of a lambent flame, and then carried her from Epidaurus to a desert island called *Oenope*, which afterwards obtained her own name.

ÆGINA, in *Ancient Geography*, an island in the Saronic bay, or bay of Engia, 20 miles distant from the Piræus, formerly vying with Athens for naval power, and at the sea-fight of Salamis disputing the palm of victory with the Athenians. It was the country and kingdom of *Æacus*, who called it *Ægina* from his mother's name, it being before called *Oenopia*, (Ovid.) The inhabitants were called *Æginetæ*, and *Æginenses*. The Greeks had a common temple dedicated to Jupiter in *Ægina*. The *Æginetæ* applied to commerce; and were the first who coined money called *Νομισμα Ἀργυρεον*; hence *Ægineticum æs*, formerly in great repute. The inhabitants were called *Myrmidones*, or a nation of ants, from their great application to agriculture. See *ÆACUS*.

The island was surrounded by Attica, the territory of Megara, and the Peloponnesus, each distant about 100 stadia, or 12 miles and a half. In circumference it was reckoned 180 stadia, or 22 miles and a half. It lies in the Sinus Saronicus, called also from this island the Gulf of Engia.

It is now called *Ægina* or *Ægina*, the *g* soft and the *i* short. The temple above mentioned is situated upon the summit of a mountain called *Panhellenius*, at some distance from the shore. The *Æginetans* affirmed it was erected by *Æacus*; in whose time Greece being terribly oppressed by drought, the Delphic oracle was consulted; and the response was, That Jupiter must be rendered propitious by *Æacus*. The cities entreated him to be their mediator: He sacrificed and prayed to Jupiter Panhellenius, and procured rain.

The temple was of the Doric order, and had six columns in front. Twenty-one of the exterior columns are yet standing, with two in the front of the pronæos and of the posticum, and five of the number which formed the ranges of the cell. The entablature, except the

Ægilops
||
Ægina.

Ægina.

the architrave, is fallen. The stone is of a light brownish colour, much eaten in many places, and indicating a very great age. Some of the columns have been injured by boring to their centres for the metal. In several, the junction of the parts is so exact, that each seems to consist of one piece. This ruin Mr Chandler considers as scarcely to be paralleled in its claim to a remote antiquity. The situation on a lonely mountain, at a distance from the sea, has preserved it from total demolition, amid all the changes and accidents of numerous centuries.

Near the shore is a barrow, raised, it is related, for Phocus upon the following occasion. Telamon and Peleus, sons of Æacus, challenged their half brother Phocus to contend in the Pentathlon. In throwing the stone, which served as a quoit, Peleus hit Phocus, who was killed; when both of them fled. Afterwards Telamon sent a herald to assert his innocence. Æacus would not suffer him to land, or to apologize, except from the vessel; or, if he chose rather, from a heap cast up in the water. Telamon, entering the private port by night, raised a barrow, as a token, it is likely, of a pious regard for the deceased. He was afterwards condemned, as not free from guilt; and sailed away again to Salamis. The barrow in the second century, when seen by Pausanias, was surrounded with a fence, and had on it a rough stone. The terror of some dreadful judgment to be inflicted from heaven had preserved it entire and unaltered to his time; and in a country depopulated and neglected, it may still endure for many ages.

The soil of this island is, as described by Strabo, very stony, especially the bottoms, but in some places not unfertile in grain. Besides corn, it produces olives, grapes, and almonds; and abounds in pigeons and partridges. It has been related, that the Æginetans annually wage war with the feathered race, carefully collecting or breaking their eggs, to prevent their multiplying, and in consequence a yearly famine. They have no hares, foxes, or wolves. The rivers in summer are all dry. The waiwode or governor farms the revenue of the Grand Signior for 12 purses, or 6000 piastres. About half this sum is repaid yearly by the catch-money, or poll tax.

ÆGINA, the capital of the above island. Its site has been long forsaken. Instead of the temples mentioned by Pausanias, there are 13 lonely churches, all very mean; and two Doric columns supporting their architrave. These stand by the sea-side toward the low cape; and, it has been supposed, are a remnant of a temple of Venus, which was situated by the port principally frequented. The theatre, which is recorded as worth seeing, resembled that of the Epidaurians both in size and workmanship. It was not far from the private port; the stadium, which, like that at Priene, was constructed with only one side, being joined to it behind, and each structure mutually sustaining and propping the other. The walls belonging to the ports and arsenal were of excellent masonry, and may be traced to a considerable extent, above, or nearly even with the water. At the entrance of the mole, on the left, is a small chapel of St Nicholas; and opposite, a square tower with steps before it, detached from which a bridge was laid across, to be removed on any alarm. This

structure, which is mean, was erected by the Venetians, while at war with the Turks in 1693.

ÆGINETA, PAULUS, a celebrated surgeon of the island of Ægina, from whence he derived his name. According to Mr Le Clerc's calculation, he lived in the fourth century; but Abulpharagius the Arabian, who is allowed to give the best account of those times, places him with more probability in the seventh. His knowledge in surgery was very great, and his works are deservedly famous. Fabricius ab Aquapendente has thought fit to transcribe him in a great variety of places. Indeed the doctrine of Paulus Ægineta, together with that of Celsus and Albucasis, make up the whole text of this author. He is the first writer who takes notice of the cathartic quality of rhubarb; and, according to Dr Milward, is the first in all antiquity who deserves the title of man-midwife.

ÆGINHARD, the celebrated secretary and supposed son-in-law of Charlemagne. He is said to have been carried through the snow on the shoulders of the affectionate and ingenious Imma, to prevent his being tracked from her apartments by the emperor's father: a story which the elegant pen of Addison has copied and embellished from an old German chronicle, and inserted in the 3d volume of the Spectator.—This happy lover (supposing the story to be true) seems to have possessed a heart not unworthy of so enchanting a mistress, and to have returned her affection with the most faithful attachment; for there is a letter of Æginhard's still extant, lamenting the death of his wife, which is written in the tenderest strain of connubial affliction; it does, not, however, express that this lady was the affectionate princess; and indeed some late critics have proved that Imma was not the daughter of Charlemagne.—But to return to our historian: He was a native of Germany, and educated by the munificence of his imperial master, of which he has left the most grateful testimony in his preface to the life of that monarch. Æginhard, after the loss of his lamented wife, is supposed to have passed the remainder of his days in religious retirement, and to have died soon after the year 840. His life of Charlemagne, his annals from 741 to 889, and his letters, are all inserted in the 2d volume of Duchesne's *Scriptores Francorum*. There is an improved edition of this valuable historian, with the annotations of Hermann Schmincke, in 4to, 1711.

ÆGIPAN, in *Heathen Mythology*, a denomination given to the god Pan, because he was represented with the horns, legs, feet, &c. of a goat.

ÆGIPHILA, GOAT-FRIEND, in *Botany*. See BOTANY Index.

ÆGIS, in the *Ancient Mythology*, a name given to the shield or buckler of Jupiter and Pallas.

The goat Amalthea, which had suckled Jove, being dead, that god is said to have covered his buckler with the skin; whence the appellation *ægis*, from *aiē*, *aiyos*, *she-goat*. Jupiter, afterwards restored the animal to life, covered it with a new skin, and placed it among the stars. He made a present of his buckler to Minerva: whence that goddess's buckler is also called *ægis*.

Minerva having killed the Gorgon Medusa, nailed her head in the middle of the *ægis*, which henceforth had

had the faculty of converting into stone all those who looked upon it; as Medusa herself had done during her life.

Others suppose the ægis not to have been a buckler, but a cuirass, or breastplate; and it is certain the ægis of Pallas, described by Virgil, *Æn.* lib. vii. ver. 435, must have been a cuirass; since that poet says expressly, that Medusa's head was on the breast of the goddess. But the ægis of Jupiter, mentioned a little higher, ver. 354, seems to have been a buckler: the words

*Cum sæpe nigrantem
Ægida concuteret dextra,*

are descriptive of a buckler; but not at all of a cuirass or breastplate.

Servius makes the same distinction on the two passages of Virgil; for on verse 354, he takes the ægis for the buckler of Jupiter, made, as above mentioned, of the skin of the goat Amalthea; and on verse 435, he describes the ægis as the armour which covers the breast, and which in speaking of men is called *cuirass*, and *ægis* in speaking of the gods. Many authors have overlooked these distinctions for want of going to the sources.

ÆGISTHUS, in ancient history, was the son of Thyestes by his own daughter Piloepia, who, to conceal her shame, exposed him in the woods; some say he was taken up by a shepherd, and suckled by a goat, whence he was called *Ægisthus*. He seduced Clytemnestra the wife of Agamemnon, and lived with her during the siege of Troy. Afterwards with her assistance he slew her husband, and reigned seven years in Mycenæ. He was, together with Clytemnestra, slain by Orestes. Pompey used to call Julius Cæsar *Ægisthus*, on account of his having seduced his wife Mutia, whom he afterwards put away, though he had three children by her.

ÆGITHALLUS, in *Ancient Geography*, a promontory and citadel of Sicily, between Drepanum and the Emporium Ægistanum, afterwards called *Acellus*; corruptly written *Ægitharsos*, in Ptolemy; situated near Mount Eryx, and now called *Capo di Santo Teodoro*.

ÆGIUM, in *Ancient Geography*, a town of Achaia *Propria*, five miles from the place where Helice stood, and famous for the council of the Achæans, which usually met there on account either of the dignity or commodious situation of the place. It was also famous for the worship of *Οὐρανὸς Ζεὺς*, *Conventional Jupiter*, and of *Panachæan Ceres*. The territory of Ægium was watered by two rivers, viz. the Phœnix and Meganites. The epithet is *Ægiensis*. There is a coin in the cabinet of the king of Prussia, with the inscription ΑΙΓΙ, and the figure of a tortoise, which is the symbol of Peloponnesus, and leaves no doubt as to the place where it was struck.

ÆGOBOLIUM, in antiquity, the sacrifice of a goat offered to Cybele. The ægobolium was an expiatory sacrifice, which bore a near resemblance to the taurobolium and criobolium, and seems to have been sometimes joined with them.

ÆGPODIUM, SMALL WILD ANGELICA, GOAT-WORT, GOATSFOOT. See *BOTANY Index*.

ÆGOPRICON. See *BOTANY Index*.

ÆGOSPOTAMOS, in *Ancient Geography*, a river in the Thracian Chersonesus, falling with a south-east course into the Hellespont, to the north of Sestos; also a town, station, or road for ships at its mouth. Here the Athenians, under Conon, through the fault of his colleague Isocrates, received a signal overthrow from the Lacedæmonians under Lysander, which was followed by the taking of Athens, and put an end to the Peloponnesian war. The Athenian fleet having followed the Lacedæmonians, anchored in the road, over against the enemy, who lay before Lampsacus. The Hellespont is not above two thousand paces broad in that place. The two armies seeing themselves so near each other, expected only to rest that day, and were in hopes of coming to a battle on the next.

But Lysander had another design in his view. He commanded the seamen and pilots to go on board their galleys, as if they were in reality to fight the next morning at break of day, to hold themselves in readiness, and to wait his orders with profound silence. He commanded the land army in like manner to draw up in order of battle upon the coast, and to wait the day without noise. On the morrow, as soon as the sun was risen, the Athenians began to row towards them with their whole fleet in one line, and to bid them defiance. Lysander, though his ships were ranged in order of battle, with their heads towards the enemy, lay still without making any movement. In the evening, when the Athenians withdrew, he did not suffer his soldiers to go ashore, till two or three galleys, which he had sent out to observe them, were returned with advice that they had seen the enemy land. The next day passed in the same manner, as did the third and fourth. Such a conduct, which argued reserve and apprehension, extremely augmented the security and boldness of the Athenians, and inspired them with an extreme contempt for an army, which fear, in their sense, prevented from showing themselves, and attempting any thing.

Whilst this passed, Alcibiades, who was near the fleet, took horse, and came to the Athenian generals: to whom he represented, that they kept upon a very disadvantageous coast, where there were neither ports nor cities in the neighbourhood; that they were obliged to bring their provisions from Sestos with great danger and difficulty; and that they were very much in the wrong to suffer the soldiers and mariners of the fleet, as soon as they were ashore, to straggle and disperse themselves at their own pleasure, whilst they were faced in view by the enemy's fleet, accustomed to execute the orders of their general with the readiest obedience, and upon the slightest signal. He offered also to attack the enemy by land with a strong body of Thracian troops, and to force them to a battle. The generals, especially Tydeus and Menander, jealous of their command, did not content themselves with refusing his offers, from the opinion, that if the event proved unfortunate, the whole blame would fall on them, and if favourable, that Alcibiades alone would have the honour of it; but rejected also with insult his wise and salutary counsel, as if a man in disgrace lost his sense and abilities with the favour of the commonwealth. Alcibiades withdrew.

The fifth day the Athenians presented themselves again,

Ægepiz
con,
Ægospota-
mos.

Ægospota-
mos
||
Ægyptilla.

again, and offered battle; retiring in the evening according to custom with more insulting airs than the days before. Lysander, as usual, detached some galleys to observe them, with orders to return with the utmost diligence when they saw the Athenians landed, and to put up a brazen buckler at each ship's head as soon as they reached the middle of the channel. He in the mean time ran through the whole line in his galley, exhorting the pilots and officers to hold the scamen and soldiers in readiness to row and fight on the first signal.

As soon as the bucklers were put up in the ships heads, and the admiral galley had given the signal by the sound of trumpet, the whole fleet set forward in good order. The land army at the same time made all possible haste to the top of the promontory to see the battle. The strait that separates the two continents in this place is about fifteen stadia, or three quarters of a league in breadth; which space was presently cleared through the activity and diligence of the rowers. Conon the Athenian general was the first who perceived from shore, that fleet advance in good order to attack him; upon which he immediately cried out for the troops to embark. In the height of sorrow and trouble, some he called by their names, some he con-jured, and others he forced to go on board their galleys; but all his endeavours and emotions were ineffectual, the soldiers being dispersed on all sides. For they were no sooner come on shore, than some ran to the sutlers, some to walk in the country, some to sleep in their tents, and others had begun to dress their suppers. This proceeded from the want of vigilance and experience in their generals, who, not suspecting the least danger, indulged themselves in taking their repose, and gave their soldiers the same liberty.

The enemy had already fallen on with loud cries and a great noise of their oars, when Conon, disengaging himself with nine galleys, of which number was the sacred ship called the *Paralian*, stood away for Cyprus, where he took refuge with Evagoras. The Peloponnesians, falling upon the rest of the fleet, took immediately the galleys which were empty, and disabled and destroyed such as began to fill with men. The soldiers, who ran without order or arms to their relief, were either killed in their endeavour to get on board, or flying on shore were cut to pieces by the enemy, who landed in pursuit of them. Lysander took 8000 prisoners, with all the generals, and the whole fleet. After having plundered the camp, and fastened the enemy's galleys to the sterns of his own, he returned to Lampsacus amidst the sound of flutes and songs of triumph. It was his glory to have achieved one of the greatest military exploits recorded in history with little or no loss, and to have terminated a war in the small space of an hour, which had already lasted 27 years, and which perhaps, without him, had been of much longer continuance.

ÆGYPT. See EGYPT.

ÆGYPTIACUM, in *Pharmacy*, the name of several detergent ointments; as black, red, white, simple, and compound.

ÆGYPTILLA, in *Natural History*, the name of a stone described by the ancients, and said, by some authors, to have the remarkable quality of giving water the colour and taste of wine. This seems a very ima-

ginary virtue, as are indeed too many of those in former ages attributed to stones. The descriptions left us of this remarkable fossil tell us, that it was variegated with, or composed of, veins of black and white, or black and bluish, with sometimes a plate or vein of whitish red. The authors of these accounts seem to have understood by this name the several stones of the onyx, sardonyx, and cameo kind; all which we have at present common among us, but none of which possesses any such strange properties.

ÆGYPTUS, in fabulous history, was the son of Belus, and brother of Danaus. See BELIDES.

ÆINAUTÆ, in antiquity, *αἰνανται*, always *mariners*, a denomination given to the senators of Miletus, because they held their deliberations on board a ship, and never returned to land till matters had been agreed on.

ÆLFRIC, an eminent ecclesiastic of the 10th century, was the son of an earl of Kent, and a monk of the Benedictine order in the monastery of Abingdon. In 963, he was settled in the cathedral of Winchester, under Athelwold the bishop, and undertook the instruction of the youth of the diocese, for which purpose he compiled a Latin Saxon vocabulary, and some Latin colloquies. He also translated from the Latin into Saxon many of the historical books of the Old Testament. While he resided at Winchester he drew up Canons, which are a kind of charge to be delivered by the bishops to their clergy. He was afterwards abbot of St Alban's, bishop of Wilton, and, finally, in 994, translated to the see of Canterbury. Here he had a hard struggle for some years in bravely defending his diocese against the incursions of the Danes. He died in 1005, and was buried at Abingdon; but his remains were removed to Canterbury in the reign of Canute. Ælfric is held up as one of the most distinguished prelates of the Saxon church. His learning, for the times, was considerable, his morals were pure, and his religious sentiments were untainted with many of the corruptions of the age in which he lived. Besides the works already mentioned, he translated two volumes of Homilies from the Latin Fathers.

ÆLFRIC, surnamed *Bata*, pupil of the former, was promoted to the archbishopric of York in 1023, and died in 1051.

ÆLFRIC, an abbot of Malmesbury in 974, was created bishop of Crediton in 974, and died in 981.

ÆLIA *Capitolina*, a name given to the city built by the emperor Adrian, A. D. 134, near the spot where the ancient Jerusalem stood, which he found in ruins when he visited the eastern parts of the Roman empire. A Roman colony was settled here, and a temple, in place of that of Jerusalem, was dedicated to Jupiter Capitolinus. Hence the name is derived, to which he prefixed that of his own family.

ÆLIAN, CLAUDIUS, born at Præneste in Italy. He taught rhetoric at Rome, according to Perizonius, under the emperor Alexander Severus. He was surnamed *Μελιγλωσσος*, *Honey-mouth*, on account of the sweetness of his style in his discourses and writings. To this excellence the poet alludes:

O jocunda, Covine, solitudo,
Carrucâ magis, essedoque gratum,
Facundi mihi munus Æliani. MARTIAL.
He

Ælian
||
Ænaria.

He was likewise honoured with the title of *Sophist*, an appellation in his days given only to men of learning and wisdom. He loved retirement, and devoted himself to study. He greatly admired and studied Plato, Aristotle, Isocrates, Plutarch, Homer, Anacreon, Archilochus, &c. and, though a Roman, gives the preference to the writers of the Greek nation. His two most celebrated works are, his *Various History*, and *History of Animals*. He composed likewise a book on Providence, mentioned by Eustathius; and another on Divine Appearances, or The Declarations of Providence. There have been several editions of his *Various History*.

ÆLII PONS, in *Ancient Geography*, one of the fortresses near the wall or rampart, or, in the words of the Notitia, through the line of the hither wall; built, as is thought, by Adrian: now named Portland, in Northumberland, between Newcastle and Morpeth, (Camden.)

ÆLIUS PONS, now *il Ponte St Angelo*, a stone bridge at Rome, over the Tiber, which leads to the Burgo and Vatican from the city, along Adrian's mole, built by the emperor Adrian.

ÆLFRED. See **ALFRED**.

ÆLURUS, in *Egyptian Mythology*, the deity or god of cats; represented sometimes like a cat, and sometimes like a man with a cat's head. The Egyptians had so superstitious a regard for this animal, that the killing it, whether by accident or design, was punished with death; and Diodorus relates, that, in the time of extreme famine, they chose rather to eat one another than touch these sacred animals.

ÆM, AM, or AME, a liquid measure used in most parts of Germany; but different in different towns: the æm commonly contains 20 vertils, or 80 masses; that of Heidelberg is equal to 48 masses; and that of Wirttemberg to 160 masses. See **AAM**.

ÆMILIUS PAULUS, the son of Æmilius Paulus who was killed at the battle of Cannæ. He was twice consul. In his first consulate he triumphed over the Ligurians; and in the second subdued Perseus king of Macedonia, and reduced that country to a Roman province, on which he obtained the surname of Macedonicus: He returned to Rome loaded with glory, and triumphed for three days. He died 168 years before Christ.

ÆMILIUS, Paulus, a celebrated historian, born at Verona, who obtained such reputation in Italy, that he was invited into France by the cardinal of Bourbon, in the reign of Louis XII. in order to write the history of the kings of France in Latin, and was presented to a canonry in the cathedral of Paris. He was near 30 years in writing that history, which has been greatly admired; and died at Paris on the 5th of May 1529.

ÆMOBOLIUM, in antiquity, the blood of a bull or ram offered in the sacrifices, called *taurobolia* and *criobolia*; in which sense the word occurs in ancient inscriptions.

ÆNARIA, in *Ancient Geography*, an island in the bay of Cumæ, or over-against Cumæ in Italy, (Pliny). It is also called *Inarime* (Virgil); and now *Ischia*; scarce three miles distant from the coast, and the promontory Misenus to the west; 20 miles in compass; called *Pithecura* by the Greeks. It is one of the *Oenotrides*, and fenced round by very high rocks, so as to

be inaccessible but on one side: it was formerly famous for its earthen-ware. See **ISCHIA**.

ÆNEAS, in fabulous history, a famous Trojan prince, the son of Anchises and Venus. At the destruction of Troy, he bore his aged father on his back, and saved him from the Greeks; but being too solicitous about his son and household gods, lost his wife Creüsa in the escape. Landing in Africa, he was kindly received by Queen Dido: but quitting her coast, he arrived in Italy, where he married Lavinia the daughter of King Latinus, and defeated Turnus, to whom she had been contracted. After the death of his father-in-law, he was made king of the Latins, over whom he reigned three years: but joining with the Aborigines, he was slain in a battle against the Tuscans. Virgil has rendered the name of this prince immortal, by making him the hero of his poem. See **ÆNEID**.

ÆNEAS SYLVIUS, *Pope*. See **PIUS II**.

ÆNEATORES, in antiquity, the musicians in an army, including those that played trumpets, horns, &c. The word is formed from *æneus*, on account of the brazen instruments used by them.

ÆNEID, the name of Virgil's celebrated epic poem. *Blair's Lectures*. The subject of the *Æneid*, which is the establishment of Æneas in Italy, is extremely happy. Nothing could be more interesting to the Romans than to look back to their origin from so famous a hero. While the object was splendid itself, the traditionary history of his country opened interesting fields to the poet; and he could glance at all the future great exploits of the Romans, in its ancient and fabulous state.

As to the unity of action, it is perfectly well preserved in the *Æneid*. The settlement of Æneas, by the order of the gods, is constantly kept in view. The episodes are linked properly with the main subject. The nodus, or intrigue of the poem, is happily managed. The wrath of Juno, who opposes Æneas, gives rise to all his difficulties, and connects the human with the celestial operations throughout the whole poem.

One great imperfection of the *Æneid*, however, is, that there are almost no marked characters in it. Achates, Cloanthes, Gyges, and other Trojan heroes who accompanied Æneas into Italy, are insipid figures. Even Æneas himself is without interest. The character of Dido is the best supported in the whole *Æneid*.

The principal excellency of Virgil is tenderness. His soul was full of sensibility. He must have felt himself all the affecting circumstances in the scenes he describes; and he knew how to touch the heart by a single stroke. In an epic poem this merit is the next to sublimity. The second book of the *Æneid* is one of the greatest masterpieces that ever was executed. The death of old Priam, and the family-pieces of Æneas, Anchises, and Creüsa, are as tender as can be conceived. In the fourth book, the unhappy passion and death of Dido are admirable. The episodes of Pallas and Evander, of Nisus and Euryalus, of Lausus and Mezentius, are all superlatively fine.

In his battles Virgil is far inferior to Homer. But in the important episode, the descent into hell, he has outdone Homer by many degrees. There is nothing in antiquity to equal the sixth book of the *Æneid*.

ÆNGINA, one of the islands of the Archipelago.

Ænaria
||
Ængina.

Ængia,
Ænigma.

It lies in the bay of Engia, and the town of that name contains about 800 houses and a castle; and near it are the ruins of a magnificent structure, which was formerly a temple.

ÆNIGMA denotes any dark saying, wherein some well known thing is concealed under obscure language. The word is Greek, *Αἰνίγμα*, formed of *αἰνιστάω*, *obscure innuere*, to hint a thing darkly, and of *αἶνος*, an obscure speech or discourse. The popular name is *riddle*; from the Belgic *raeden*, or the Saxon *araethan*, to interpret. F. Bouhours, in the memoirs of Trevoux, defines an ænigma, a discourse or painting, including some hidden meaning, which is proposed to be guessed.

Painted ÆNIGMAS, are representations of the works of nature or art, concealed under human figures, drawn from history or fable.

A Verbal ÆNIGMA, is a witty, artful, and abstruse description of any thing.—In a general sense, every dark saying, every difficult question, every parable, may pass for an *ænigma*. Hence obscure laws are called *Ænigmata Juris*. The alchemists are great dealers in the ænigmatic language, their processes for the philosopher's stone being generally wrapt up in riddles: e. g. *Fac ex mare et fœmina circumum, inde quadrangulum hinc triangulum, fac circumum, et habebis lapidem philosophorum*.—F. Menestrier has attempted to reduce the composition and resolution of ænigmas to a kind of art, with fixed rules and principles, which he calls the philosophy of *ænigmatic images*.

The Subject of an ÆNIGMA, or the thing to be concealed and made a mystery of, he justly observes, ought not to be such in itself; but, on the contrary, common, obvious, and easy to be conceived. It is to be taken, either from nature, as the heaven or stars; or from art, as painting, the compass, a mirror, or the like.

The Form of ÆNIGMAS consists in the words, which, whether they be in prose or verse, contain either some description, a question, or a prosopopœia. The last kind are the most pleasing, inasmuch as they give life and action to things which otherwise have them not. To make an ænigma, therefore, two things are to be pitched on which bear some resemblance to each other, as the sun and a monarch; or a ship and a house; and on this resemblance is to be raised a superstructure of contrarieties to amuse and perplex. It is easier to find great subjects for ænigmas in figures than in words; inasmuch as painting attracts the eyes and excites the attention to discover the sense. The subjects of ænigmas in painting are to be taken either from history or fable: the composition here is a kind of metamorphosis, wherein, e. g. human figures are changed into trees, and rivers into metals. It is essential to ænigmas, that the history or fable, under which they are presented, be known to every body: otherwise it will be two ænigmas instead of one; the first of the history or fable, the second of the sense in which it is to be taken. Another essential rule of the ænigma is, that it only admits of one sense. Every ænigma which is susceptible of different interpretations, all equally natural, is so far imperfect. What gives a kind of erudition to an ænigma, is the invention of figures in situations, gestures, colours, &c. authorised by passages of

the poets, the customs of artists in statues, basso relievos, inscriptions, and medals.—In foreign colleges,

Ænigma.

The Application of ÆNIGMAS makes a considerable exercise; and that one of the most difficult and amusing, where wit and penetration have the largest field.—By explaining an ænigma, is meant the finding a motto corresponding to the action and persons represented in a picture, taken either from history or mythology. The great art of this exercise consists in the choice of a motto, which either by itself, or the circumstances of time, place, person who speaks, or those before whom he is speaking, may divert the spectators, and furnish occasion for strokes of wit; also in showing to advantage the conformities between the figure and thing figured, giving ingenious turns to the reasons employed to support what is advanced, and in artfully introducing pieces of poetry to illustrate the subject and awaken the attention of the audience.

As to the solution of enigmas, it may be observed, that those expressed by figures are more difficult to explain than those consisting of words, by reason images may signify more things than words can; so that to fix them to a particular sense, we must apply every situation, symbol, &c. and without omitting a circumstance.—As there are few persons in history, or mythology, but have some particular character of vice or virtue, we are, before all things, to attend to this *character*, in order to divine what the figure of a person represented in a painting signifies, and to find what agreement this may have with the subject whereof we would explain it. Thus, if Proteus be represented in a picture, it may be taken to denote *inconstancy*, and applied either to a physical or moral subject, whose character is to be changeable, e. g. an almanack, which expresses the weather, the seasons, heat, cold, storms, and the like. The *colours* of figures may also help to unriddle what they mean: *white*, for instance, is a mark of innocence, *red* of modesty, *green* of hope, *black* of sorrow, &c. When figures are accompanied with *symbols*, they are less precarious; these being, as it were, the soul of ænigmas, and the key that opens the mystery of them. Of all the kinds of symbols which may be met with in those who have treated professedly on the subject, the only true ænigmatical are those of Pythagoras, which, under dark proverbs, hold forth lessons of morality; as when he says *Stateram ne transilias*, to signify, Do no injustice.

But it must be added, that we meet with some ænigmas, in history, complicated to a degree which much transcends all rules, and has given great perplexity to the interpreters of them. Such is that celebrated ancient one, *Ælia Lælia Crispis*, about which many of the learned have puzzled their heads. There are two exemplars of it: one found 140 years ago, on a marble near Bologna: the other in an ancient MS. written in Gothic letters at Milan. It is controverted between the two cities, which is to be reputed the more authentic.

The Bononian Ænigma.

D. M.

Ælia Lælia Crispis,

Nec vir, nec mulier,

Nec androgyna;

Nec puella, nec juvenis,

Nec

*Nec anus ;
Nec casta, nec meretrix,
Nec pudica ;
Sed omnia :
Sublata
Neque fame, neque ferro,
Neque veneno ;
Sed omnibus :
Nec celo, nec terris,
Nec aquis,
Sed ubique jacet.
Lucius Agatho Priscius,
Nec maritus, nec amator,
Nec necessarius ;
Neque mœrens, neque gaudens,
Neque flens ;
Hanc,
Nec molem, nec pyramidem,
Nec sepulchrum,
Sed omnia,
Scit et nescit, cui posuerit.*

That is to say, *To the gods manes, Ælia Lælia Crispis*, neither man, nor woman, nor hermaphrodite ; neither girl, nor young woman, nor old ; neither chaste, nor a whore ; but all these : killed neither by hunger, nor steel, nor poison ; but by all these : rests neither in heaven, nor on earth, nor in the waters ; but everywhere. *Lucius Agatho Priscius*, neither her husband, nor lover, nor friend ; neither sorrowful, nor joyful, nor weeping, certain, or uncertain, to whom he rears this monument, neither erects her a temple, nor a pyramid, nor a tomb, but all these. In the MS. at Milan, instead of *D. M.* we find *A. M. P. P. D.* and at the end the following addition :

*Hoc est sepulchrum intus cadaver non habens.
Hoc est cadaver sepulchrum extra non habens,
Sed cadaver idem est et sepulchrum.*

We find near 50 several solutions of this ænigma advanced by learned men. *Marius Michael Angelo* maintains *Ælia Lælia Crispis* to signify rain water falling into the sea. *Ri.* *Vitus* first explained it of *Niobe*, turned to a stone, afterwards of the rational soul, and afterwards of the Platonic idea ; *Jo. Turrius*, of the *materia prima* ; *Fr. Schottus*, of an eunuch ; *Nic. Bernardus*, of the philosopher's stone, in which he is followed by *Borrichius* ; *Zach. Pontinus*, of three human bodies, in the same situation ; and buried by three different men at the same time ; *Nesmondus*, of a law-suit ; *Jo. Gas. Gerartius*, of love ; *Zu. Boxhornius*, of a shadow ; *P. Terronus*, of music ; *Fort. Licetus*, of generation, friendship and privation ; *M. Ov. Montalbanus*, of hemp ; *Car. Cæs. Malvasia*, of an abortive girl promised in marriage ; *Pet. Mengulus*, of the rule of chastity, prescribed by the founder of the military religion of *St Mary* ; *M. de Ciconia*, of *Pope Joan* ; *Heumannus*, of *Lot's wife* ; and lastly, *J. C. S.* an anonymous writer in the *Leipsic Acts*, of the *Christian church*.

ÆNIGMATOGRAPHY, or **ÆNIGMATHOLOGY**, the art of resolving or making ænigmas.

ÆNONA, in *Ancient Geography*, a city of *Liburnia*, called by *Pliny Civitas Prasini*, the reason of which is unknown ; also *Enona* ; and is now called

Nona ; on the *Adriatic*, by which it is for the greater part surrounded ; over against the island *Gissa*, from which it is distant four miles to the west. E. Long. 16°. N. Lat. 28°.

Ænona
||
Æolipile.

ÆNUS, in *Ancient Geography*, now the *Inn*, a river of *Germany*, which, rising in the country of the *Grisons*, out of the *Alps*, in the district called *Gotteshaus-punt*, runs through the *Grisons*, the county of *Tyrol*, the duchy of *Bavaria*, and through *Passau* into the *Danube*.

ÆNUS, *Ænos*, or *Ænum*, in *Ancient Geography*, a town of *Thrace*, situated on the eastmost mouth of the *Hebrus*, which has two mouths ; and said to be built by the *Cumeans*. It was a free town, in which stood the tomb of *Polydorus*, (*Pliny*) ; *Ænius* is the epithet. Here the brother of *Cato Uticensis* died, and was honoured with a monument of marble in the forum of the *Ænii*, (*Plutarch*) ; called *Ænei*, (*Stephanus*). *Livy* says that the town was otherwise called *Absynthus*. Now *Eno*.

ÆNITHOLOGUS, in *Poetry*, a verse of two dactyls and three trochæi ; as *Prælia dira placent truci juventæ*.

ÆOLIÆ INSULÆ, now *Isoli Lipari*, in *Ancient Geography*, seven islands, situated between *Sicily* and *Italy* ; so called from *Æolus*, who reigned there about the time of the *Trojan war*. The Greeks call them *Hephestiades* ; and the Romans *Vulcaniæ*, from their fiery eruptions. They are also called *Liparæorum Insulæ*, from their principal island *Lipara*. *Dionysius Periegetes* calls them Πλῆλαι, because circumnavigable.

ÆOLIC, in a general sense, denotes something belonging to *Æolis*.

ÆOLIC, or **ÆOLIAN**, in *Grammar*, denotes one of the five dialects of the Greek tongue. It was first used in *Bœotia* ; whence it passed into *Æolia*, and was that which *Sappho* and *Alcæus* wrote in. The *Æolic* dialect generally throws out the aspirate or sharp spirit, and agrees in so many things with the *Doric* dialect, that the two are usually confounded together.

The *Æolic digamma* is a name given to the letter *F*, which the *Æolians* used to prefix to words beginning with vowels, as *Foivos*, for *oivos* ; also to insert between vowels, as *oFis*, for *ois*.

ÆOLIC Verse, in *Prosody*, a verse consisting of an iambus, or spondee ; then of two anapests, separated by a long syllable ; and, lastly, of another syllable. Such as, *O stelliferi conditor orbis*. This is otherwise called *eulogic verse* ; and, from the chief poets who used it, *Archilochian* and *Pindaric*.

ÆOLIPILE, in *Hydraulics*, is a hollow ball of metal, generally used in courses of experimental philosophy, in order to demonstrate the possibility of converting water into an elastic steam or vapour by heat. The instrument, therefore, consists of a slender neck, or pipe, having a narrow orifice inserted into the ball by means of a shouldered screw. This pipe being taken out, the ball is filled almost full of water, and the pipe being again screwed in, the ball is placed on a pan of kindled charcoal, where it is well heated, and there issues from the orifice a vapour, with prodigious violence and great noise, which continues till all the included water is discharged. The stronger the fire is, the more elastic and violent will be the steam ; but care must be taken that the small orifice of the pipe be not,

Æolipile
||
Æon.

by any accident, stopped up; because the instrument would in that case infallibly burst in pieces, with such violence as might greatly endanger the lives of the persons near it. Another way of introducing the water is to heat the ball red hot when empty, which will drive out almost all the air; and then by suddenly immersing it in water, the pressure of the atmosphere will force in the fluid, till it is nearly full. Des Cartes and others have used this instrument to account for the natural cause and generation of the wind: and hence it was called *Æolipila*: q. d. *pila Æoli*, the ball of Æolus or of the god of the winds.

ÆOLIS, or *ÆOLIA*, in *Ancient Geography*, a country of the Hither Asia, settled by colonies of Æolian Greeks. Taken at large, it comprehends all Troas, and the coast of the Hellespont to the Propontis, because in those parts there were several Æolian colonies: more strictly, it is situated between Troas to the north, and Ionia to the south. The people are called *Æoles* or *Æolii*.

ÆOLIUM MARE, in *Ancient Geography*, a part of the Ægean sea, washing Æolis; called also *Mysium*, from Mysia. Now called *Golfo di Smyrna*.

ÆOLUS, in heathen mythology, the god of the winds, was said to be the son of Jupiter by Acasta, or Sigesia, the daughter of Hippotus: or, according to others, the son of Hippotus by Meneclea, daughter of Hyllus king of Lipara. He dwelt in the island Strongyle, now called *Strombolo*, one of the seven islands called *Æolian* from their being under the dominion of Æolus. Others say, that his residence was at Rhegium, in Italy: and others again place him in the island Lipara. He is represented as having authority over the winds, which he held enchained in a vast cavern, to prevent their continuing the devastations they had been guilty of before they were put under his direction. Mythologists explain the original of these fables, by saying, that he was a wise and good prince; and, being skilled in astronomy, was able, by the flux and reflux of the tides, and the nature of the volcano in the island Strongyle, to foretel storms and tempests.

Harp of ÆOLUS, or the Æolian lyrc. See ACOUSTICS.

ÆON, a Greek word, properly signifying the age or duration of any thing.

ÆON, among the followers of Plato, was used to signify any virtue, attribute, or perfection: hence they represented the deity as an assemblage of all possible æons; and called him *pleroma*, a Greek term signifying *fulness*. The Valentinians, who, in the first ages of the church, blended the conceits of the Jewish cabalists, the Platonists, and the Chaldean philosophers, with the simplicity of the Christian doctrine, invented a kind of Theogony, or Genealogy of Gods (not unlike that of Hesiod), whom they called by several glorious names, and all by the general appellation of *ÆONS*: among which they reckoned *Zon*, *Life*; *Λογος*, *Word*; *Μονογενος*, *Only-begotten*; *Πληρωμα*, *Fulness*; and many other divine powers and emanations, amounting in number to thirty; which they fancied to be successively derived from one another; and all from one self-originated deity, named *Bythus*, i. e. *profound* or *unfathomable*; whom they called likewise, *The most high and ineffable Father*. See VALENTINIANS.

Æora
||
Æra.

ÆORA, among ancient writers on medicine, is used for gestation; which sort of exercise was often prescribed by the physicians of those days. Other exercises consisted principally in the motion of the body; but in the *æora* the limbs were at rest, while the body was carried about and moved from place to place, in such a manner as the physician prescribed. It had therefore the advantage of exercise, without the fatigue of it.—This exercise was promoted several ways: sometimes the patient was laid in a sort of hammock, supported by ropes, and moved backward and forward; sometimes his bed run nimbly on its feet. And sometimes he was carried in a litter, in a boat or ship, or on even ground in a chariot.—Asclepiades was the first who brought gestation into practice, which was used as a means to recover strength after a fever, &c.

ÆPINUS, F. U. T. a German mathematician and philosopher. See SUPPLEMENT.

ÆQUANA JUGA, in *Ancient Geography*, mountains of Picenum, in the kingdom of Naples, now called *Montagna di Sorrento*, denominated from the town Æqua, which being destroyed, was replaced by Vicus, now *Vico di Sorrento*: called also *Æquana*, (Sil. Italicus).

ÆQUIMELIUM, in antiquity, a place in Rome, where stood the house of Spurius Mælius, who, by largesses corrupting the people, affected the supreme power: refusing to appear before the dictator Cincinnatus, he was slain by Servilius Ahala, master of the horse; his house was razed to the ground; and the spot on which it stood was called *Area Equimælii*, (Livy).

ÆRA, in chronology, a fixed point of time from whence any number of years is begun to be counted.

It is sometimes also written in ancient authors *Æra*. The origin of the term is contested, though it is generally allowed to have had its rise in Spain. Sepulveda supposes it formed from A. E. R. A. the notæ or abbreviatures of the words, *annus erat Augusti*, occasioned by the Spaniards beginning their computation from the time their country came under the dominion of Augustus, or that of receiving the Roman calendar. This opinion, however ingenious, is rejected by Scaliger, not only on account that in the ancient abbreviatures *A* never stood for *annus*, unless when preceded by *V* for *vixit*; and that it seems improbable they should put ER for *erat*, and the latter A, without any discrimination, both for *annus* and *Augustus*. Vossius nevertheless favours the conjecture, and judges it at least as probable, as either that of Isidore, who derives *æra* from *æs*, the "tribute-money," wherewith Augustus taxed the world: or that of Scaliger himself, who deduces it likewise from *æs*, though in a different manner. *Æs*, he observes, was used among the ancients for an *article* or *item* in an account; and hence it came also to stand for a sum or number itself. From the plural *æra*, came by corruption *æra*, *æram*, in the singular: much as *Ostia*, *Ostiam*, the name of a place, from *Ostia*, the mouths of the Tyber.

The difference between the terms *æra* and *epoch* is, that the *æras* are certain points fixed by some people, or nation; and the *epochs* are points fixed by chronologists and historians. The idea of an *æra* comprehends also a certain succession of years proceeding from a fixed point of time, and the *epoch* is that point itself. Thus the

the Christian æra began at the epoch of the birth of Jesus Christ. See CHRONOLOGY, where the different Eras, &c. are enumerated and explained.

ÆRARIUM, the treasury or place where the public money was deposited amongst the Romans.

ÆRARIUM Sanctius contained the moneys arising from the twentieth part of all legacies: this was kept for the extreme necessities of the state.

ÆRARIUM Privatum was the emperor's privy purse, or the place where the money arising from his private patrimony was deposited.

ÆRARIUM Vicesimarum, the place where the money arising from the taxes levied from foreign countries was laid up, so called because it most commonly consisted of a twentieth part of the produce.

ÆRARIUM liltlayæ, or *Junonis Lucinæ*, was where the moneys were deposited which parents paid for the birth of each child.

There are several other treasuries mentioned in history, as the *ærarium Juventutis*, *Veneris*, &c. The temple of Saturn was the public treasury of Rome, either because Saturn first taught the Italians to coin money, or, which is most likely, because this temple was the strongest and most secure, and therefore the fittest, place for that purpose.

Ærarium differs from *fiscus*, as the first contained the public money, the second that of the prince. The two are, however, sometimes indiscriminately used for each other.

ÆRARIUS, a name given by the Romans to a degraded citizen, who had been struck off the list of his century. Such persons were so called, because they were liable to all the taxes (*æra*), without enjoying any of its privileges.

The *ærarii* were incapable of making a will, of inheriting, of voting in assemblies, of enjoying any post of honour or profit; in effect, were only subject to the burdens, without the benefits of society; yet they retained their freedom, and were not reduced to the condition of slaves. To be made an *ærarius* was a punishment inflicted for some offence, and reputed one degree more severe than to be expelled a tribe, *tribu moveri*.

ÆRARIUS was also an officer instituted by Alexander Severus, for the distribution of the money given in largesses to the soldiery or people.

ÆRARIUS was also used for a person employed in coining or working brass.

These are sometimes called *ærarii fusores*; at other times, *ærarius* is distinguished from *fusor*; the former answering to what we now call coppersmiths, the latter to founders.

ÆRARIUS was likewise applied to a soldier who receives pay.

ÆRIA, or **EERIA**, in *Ancient Geography*, the ancient name of Egypt. The scholiast on Apollonius Rhodius, says, that not only Thessaly, but Egypt, was called *Higia* by the Greeks, which Eusebius also confirms: and hence Apollinarius, in his translation of the 114th Psalm, uses it for Egypt. Hesychius applies this name to Ethiopia.

AERIAL, in a general sense, denotes something partaking of the nature of air; thus aerial substances, aerial particles, &c.

AERIAL Perspective. See PERSPECTIVE and PAINTING.

AERIANS, in church history, a branch of Arians, who, to the doctrines of that sect, added some peculiar dogmas of their own; as, that there is no difference between bishops and priests; a doctrine maintained by many modern divines, particularly of the presbyterian and reformed churches. The sect received its denomination from Aërius an Armenian priest of the fourth century. He founded his doctrine chiefly upon some passages in St Paul; and, among others, upon that in 1 Tim. iv. 14. where the apostle exhorts him not to neglect the gift he had received by the laying on of the hands of the Presbytery. Here, observes Aërius, is no mention of bishops: on the contrary, Timothy evidently received his ordination from the presbyters or priests.—Epiphanius zealously maintains the superiority of bishops against the Aerians. The word *presbytery*, used by the apostle, he observes, includes both bishops and priests; the whole senate or assembly of the ecclesiastics of the place.

FLOS ÆRIS, among alchemists, small scales procured from copper melted by a strong heat; it is sometimes used for *ærugô* or verdigris.

AEROGRAPHY, from *αἰρ*, air, and *γραφω*, I describe; a description of the air or atmosphere, its limits, dimensions, properties, &c. This amounts to much the same with aerology, unless we suppose the latter to enter into the rationale, and the former to confine itself to a description of the more obvious affections thereof. See METEOROLOGY.

AEROMANCY, a species of divination performed by means of air, wind, &c. See DIVINATION.

AEROMETRY, the science of measuring the air. It comprehends not only the doctrine of the air itself, considered as a fluid body, but also its pressure, elasticity, rarefaction, and condensation. But the term is at present not much in use, this branch of natural philosophy being more frequently called Pneumatics. See PNEUMATICS.

AERONAUT, a person who navigates or floats in the air by means of an air balloon. See AEROSTATION.

AERONAUTICA, from *αἰρ*, and *ναυτικός*, derived from *ναυς*, ship; the art of sailing in a vessel or machine through the atmosphere, sustained as a ship in the sea. See AEROSTATION.

AEROPHYLACEA, a term used by naturalists for caverns or reservoirs of air, supposed to exist in the bowels of the earth. Kircher speaks much of aerophylacea, or huge caverns replete with air, disposed under ground; from whence, through numerous occult passages, that element is conveyed either to subterraneous receptacles of water, which, according to him, are hereby raised into springs or rivers, or into the funds of subterraneous fire, which are hereby fed and kept alive for the restoration of metals, minerals, and the like.

AEROSTATION,

Aerial
||
Aerophylacea.

AEROSTATION,

IN its primitive sense, denotes the science of weights suspended in the air; but in its modern acceptation, it signifies *aerial navigation*, or the art of navigating through the atmosphere. Hence also the machines which are employed for this purpose are called *aerostats*, or *aerostatic machines*; and from their globular shape, *air balloons*.

The romances of almost every nation have recorded instances of persons being carried through the air, both by the agency of spirits and by mechanical inventions; but till the time of Friar Bacon, who died in 1292, no rational principle appears ever to have been thought of by which this might be accomplished. He had written upon the subject, and not only assures us of the practicability of the art, but that he knew how to construct a machine in which a man might transport himself through the air like a bird; and he affirms that the experiment had been successfully made by another person. The machine consisted of two large thin shells, or hollow globes of copper, which were exhausted of air; and thus being lighter than air, would support a chair on which a person might sit.

Many had been of opinion, that by means of artificial wings, fixed to the arms or legs, a man might fly as well as a bird: but these opinions were thoroughly refuted by Borelli in his treatise *De Motu Animalium*, where, from a comparison between the power of the muscles which move the wings of a bird, and those which move the arms of a man, he demonstrates that the latter are utterly insufficient to strike the air with such force as to raise him from the ground. It cannot be denied, however, that wings of this kind, if properly constructed, and dexterously managed, might be sufficient to break the fall of a human body from a high place, so that some adventurers in this way might possibly come off with safety; though by far the greatest number of those who have rashly adopted such schemes, have either lost their lives or limbs in the attempt.

In the year 1672, Bishop Wilkins published a treatise, entitled, *The Discovery of the New World*; in which he mentions, though in a very indistinct and confused manner, the true principle on which the air is navigable; quoting, from Albertus de Saxonia and Francis Mendoza, "that the air is in some part of it navigable: and upon this static principle, any brass or iron vessel (suppose a kettle), whose substance is much heavier than that of water, yet being filled with the lighter air, it will swim upon it and not sink. So suppose a cup or wooden vessel upon the outward borders of this elementary air, the capacity of it being filled with fire, or rather ethereal air, it must necessarily, upon the same ground, remain swimming there, and of itself can no more fall than an empty ship can sink." This idea, however, he did not by any means pursue, but rested his hopes entirely upon mechanical motions, to be accomplished by the mere strength of a man, or by springs, &c. and which have been demonstrated incapable of answering any useful purpose.

The only person who brought his scheme of flying to any kind of rational principle was the Jesuit Francis Lana, cotemporary with Bishop Wilkins. His method was similar to Friar Bacon's. He was acquainted with the real weight of the atmosphere, and, justly concluded, that if a globular vessel were exhausted of air, it would weigh less than before; and considering that the solid contents of vessels increase in much greater proportion than their surfaces; he supposed that a metalline vessel might be made so large, that, when emptied of its air, it would be able not only to raise itself in the atmosphere, but to carry up passengers along with it: and he made a number of calculations necessary for putting the project in execution. But though the theory was here unexceptionable, the means proposed were certainly insufficient to accomplish the end: for a vessel of copper, made so thin as was necessary to make it float in the atmosphere, would be utterly unable to resist the external pressure; which being demonstrated by those skilled in mechanics, no attempt was made on that principle.

In the year 1709, however, as we are informed by a letter published in France in 1784, a Portuguese projector, Friar Gusman, applied to the king for encouragement to his invention of a flying machine. The principle on which his was constructed, if indeed it had any principle, seems to have been that of the paper kite. The machine was constructed in form of a bird, and contained several tubes through which the wind was to pass, in order to fill a kind of sails, which were to elevate it; and when the wind was deficient, the same effect was to be performed by means of bellows concealed within the body of the machine. The ascent was also to be promoted by the electric attraction of pieces of amber placed in the top, and by two spheres enclosing magnets in the same situation.

These childish inventions show the low state of science at that time in Portugal, especially as the king, in order to encourage him to farther exertions in such an useful invention, granted him the first vacant place in his college of Barcelos or Santarem, with the first professorship in the university of Coimbra, and an annual pension of 600,000 reis during his life. Of this De Gusman, it is also related, that, in the year 1736, he made a wicker basket of about seven or eight feet diameter, and covered with paper, which raised itself about 200 feet in the air, and the effect was generally attributed to witchcraft.

In the year 1766, Mr Henry Cavendish ascertained the weight and other properties of inflammable air, determining it to be at least seven times lighter than common air. Soon after which it occurred to Dr Black, that perhaps a thin bag filled with inflammable air might be buoyed up by the common atmosphere, and he thought of having the allantois of a calf prepared for this purpose; but his other avocations prevented him from prosecuting the experiment. The same thought occurred some years afterwards to Mr Cavallo; and he has the honour of being the first who made experiments

Friar Bacon first published the true principles of aerostation.

Impossibility of flying by mechanical means.

Scheme of Bishop Wilkins and Albertus de Saxonia.

Possibility of bodies rising in the air thought of by Dr Black and Mr Cavallo.

periments on the subject. He first tried bladders; but the thinnest of these, however well scraped and prepared, were found too heavy. He then tried Chinese paper; but that proved so permeable, that the vapour passed through it like water through a sieve. His experiments, therefore, made in the year 1782, proceeded no farther than blowing up soap bubbles with inflammable air, which ascended rapidly to the ceiling, and broke against it.

But while the discovery of the art of aerostation seemed thus on the point of being made in Britain, it was all at once announced in France, and that from a quarter whence nothing of the kind was to have been expected. Two brothers, Stephen and John Montgolfier, natives of Annonay, and masters of a considerable paper manufactory there, had turned their thoughts towards this project as early as the middle of the year 1782. The idea was first suggested by the natural ascent of the smoke and clouds in the atmosphere; and their design was to form an artificial cloud, by enclosing the smoke in a bag, and making it carry up the covering along with it. Towards the middle of November that year the experiment was made at Avignon with a fine silk bag of a parallelopiped shape. By applying burning paper to the lower aperture, the air was rarefied, and the bag ascended in the atmosphere, and struck rapidly against the ceiling. On repeating the experiment in the open air, it rose to the height of about 70 feet.

An experiment on a more enlarged scale was now projected; and a new machine, containing about 650 cubic feet was made, which broke the cords that confined it, and rose to the height of about 600 feet. Another of 35 feet in diameter rose about 1000 feet high, and fell to the ground three quarters of a mile from the place where it ascended. A public exhibition was next made on the 5th of June 1783, at Annonay, where a vast number of spectators assembled. An immense bag of linen, lined with paper, and containing upwards of 23,000 cubic feet, was found to have a power of lifting about 500 pounds, including its own weight. The operation was begun by burning chopped straw and wool under the aperture of the machine, which immediately began to swell: and after being set at liberty ascended into the atmosphere. In ten minutes it had ascended 6000 feet; and when its force was exhausted, it fell to the ground at the distance of 7668 feet from the place from whence it set out.

Soon after this, one of the brothers arrived at Paris, where he was invited by the Academy of Sciences to repeat his experiments at their expence. In consequence of this invitation, he constructed, in a garden in the fauxbourg of St Germain, a large balloon of an elliptical form. In a preliminary experiment, this machine lifted up from the ground eight persons who held it, and would have carried them all off if more had not quickly come to their assistance. Next day the experiment was repeated in presence of the members of the academy; the machine was filled by the combustion of 50 pounds of straw made up in small bundles, upon which about 12 pounds of chopped wool were thrown at intervals. The usual success attended this exhibition: the machine soon swelled; endeavoured to ascend; and immediately after sustained itself in the air, together with the charge of between 400 and 500

pounds weight. It was evident that it would have ascended to a great height; but as it was designed to repeated the experiment before the king and royal family at Versailles, the cords by which it was tied down were not cut. But in consequence of a violent rain and wind which happened at this time, the machine was so far damaged, that it became necessary to prepare a new one for the time that it had been determined to honour the experiment with the royal presence; and such expedition was used, that this vast machine, of near 60 feet in height and 43 in diameter, was made, painted with water colours both within and without, and finely decorated, in no more than four days and four nights. Along with this machine was sent up a wicker cage, containing a sheep, a cock, and a duck, which were the first animals ever sent through the atmosphere. The full success of the experiment was prevented by a violent gust of wind which tore the cloth in two places near the top before it ascended; however, it rose to the height of 1440 feet; and after remaining in the air about eight minutes, fell to the ground at the distance of 10,200 feet from the place of its setting out. The animals were not in the least hurt.

The great power of these aerostatic machines, and their very gradual descent in falling to the ground, originally showed that they were capable of transporting people through the air with all imaginable safety; and this was further confirmed by the experiment already mentioned. As M. Montgolfier, therefore, proposed to make a new aerostatic machine of a firmer and better construction than the former, M. Pilatre de Rozier offered himself to be the first aërial adventurer.

This new machine was constructed in a garden in the fauxbourg of St Antoine. It was of an oval shape, about 48 feet in diameter, and 74 in height, elegantly painted on the outside with the signs of the zodiac, cyphers of the king's name, and other ornaments. A proper gallery, grate, &c. were appended in the manner afterwards described; so that it was easy for the person who ascended to supply the fire with fuel, and thus keep up the machine as long as he pleased. The weight of the whole apparatus was upwards of 1600 pounds. The experiment was performed on the 15th of October 1783. M. Pilatre having placed himself in the gallery, the machine was inflated, and permitted to ascend to the height of 84 feet, where he kept it afloat for about four minutes and a half: after which he descended very gently: and such was its tendency to ascend, that it rebounded to a considerable height after touching the ground. Two days after, he repeated the experiment with the same success as before; but the wind being strong, the machine did not sustain itself so well as formerly. On repeating the experiment in calmer weather, he ascended to the height of 210 feet. His next ascent was 262 feet; and in the descent, a gust of wind having blown the machine over some large trees of an adjoining garden, M. Pilatre suddenly extricated himself from so dangerous a situation, by throwing some straw and chopped wool on the fire, which raised him at once to a sufficient height. On descending again, he once more raised himself to a proper height by throwing straw on the fire. Some time after, he ascended in company with M. Girond

Some animals safely sent thro' the air.

M. Pilatre de Rozier the first aërial navigator.

Account of his different voyages.

M. Girond de Villette to the height of 330 feet; hovering over Paris at least nine minutes in sight of all the inhabitants, and the machine keeping all the while perfectly steady.

These experiments had shown, that the aerostatic machines might be raised or lowered at the pleasure of the persons who ascended: they had likewise discovered, that the keeping them fast with ropes was no advantage; but, on the contrary, that this was attended with inconvenience and hazard. On the 21st of November 1783, therefore, M. Pilatre determined to undertake an aerial voyage in which the machine should be fully set at liberty. Every thing being got in readiness, the balloon was filled in a few minutes; and M. Pilatre placed himself in the gallery, counterpoised by the marquis d'Arlandes, who occupied the other side. It was intended to make some preliminary experiments on the ascending power of the machine; but the violence of the wind prevented this from being done, and even damaged the balloon essentially; so that it would have been entirely destroyed had not timely assistance been given. The extraordinary exertions of the workmen, however, repaired it again in two hours, and the adventurers set out. They met with no inconvenience during their voyage, which lasted about 25 minutes; during which time they had passed over a space of above five miles.—From the account given by the marquis d'Arlandes, it appears that they met with several different currents of air; the effect of which was, to give a very sensible shock to the machine, and the direction of the motion seemed to be from the upper part downwards. It appears also that they were in some danger of having the balloon burnt altogether; as the marquis observed several round holes made by the fire in the lower part of it, which alarmed him considerably, and indeed not without reason. However, the progress of the fire was easily stopped by the application of a wet sponge, and all appearance of danger ceased in a very short time.

This voyage of M. Pilatre and the marquis d'Arlandes may be said to conclude the history of those aerostatic machines which are elevated by means of fire; for though many other attempts have been made upon the same principle, most of them have either proved unsuccessful or were of little consequence. They have therefore given place to the other kind filled with inflammable air (*hydrogen gas*); which, by reason of its smaller specific gravity, is both more manageable and capable of performing voyages of greater length, as it does not require to be supplied with fuel like the others. This was invented a very short time after the discovery had been made by M. Montgolfier. This gentleman had indeed designed to keep his method in some degree a secret from the world; but as it could not be concealed, that a bag filled with any kind of fluid lighter than the common atmosphere would rise in it, inflammable air was naturally thought of as a proper succedaneum for the rarefied air of M. Montgolfier. The first experiment was made by two brothers Messrs Roberts, and M. Charles a professor of experimental philosophy. The bag which contained the gas was composed of lutestring, varnished over with a solution of the elastic gum called *caoutchouc*; and that with which they made their first essay was only about 13 English feet in

diameter. Many difficulties occurred in filling it with the inflammable air, chiefly owing to their ignorance of the proper apparatus; insomuch, that, after a whole day's labour from nine in the morning, they had got the balloon only one-third part full. Next morning they were surprised to find that it had fully inflated of itself during the night; but, upon inquiry, it was found, that they had inadvertently left open a stop-cock connected with the balloon, by which the common air gaining access, had mixed itself with the inflammable air; forming a compound still lighter than the common atmosphere, but not sufficiently light to answer the purposes of aerostation. Thus they were obliged to renew their operation; and, by six o'clock in the evening of next day, they found the machine considerably lighter than the common air; and, in an hour after, it made a considerable effort to ascend. The public exhibition, however, had been announced only for the third day after; so that the balloon was allowed to remain in an inflated state for a whole day; during which they found it had lost a power of ascent equal to about three pounds, being one-seventh part of the whole. When it was at last set at liberty, after having been well filled with inflammable air, it was 35 pounds lighter than an equal bulk of common air. It remained in the atmosphere only three quarters of an hour, during which it had traversed 15 miles. Its sudden descent was supposed to have been owing to a rupture which had taken place when it ascended into the higher regions of the atmosphere.

The success of this experiment, and the aerial voyage made by Messrs Rozier and Arlandes, naturally suggested the idea of undertaking something of the same kind with a balloon filled with inflammable air. The machine used on this occasion was formed of gores of silk, covered over with a varnish made of *caoutchouc*, of a spherical figure, and measuring $27\frac{1}{2}$ feet in diameter. A net was spread over the upper hemisphere, and was fastened to a hoop which passed round the middle of the balloon. To this a sort of car, or rather boat was suspended by ropes, in such a manner as to hang a few feet below the lower part of the balloon: and, in order to prevent the bursting of the machine, a valve was placed in it; by opening of which, some of the inflammable air might be occasionally let out. A long silken pipe communicated with the balloon, by means of which it was filled. The boat was made of basket work, covered with painted linen, and beautifully ornamented; being 8 feet long, 4 broad, and $3\frac{1}{2}$ deep; its weight 130 pounds. At this time, however, as at the former, they met with great difficulties in filling the machine with inflammable air, owing to their ignorance of the most proper apparatus. But at last, all obstacles being removed, the two adventurers took their seats at three quarters after one in the afternoon of the first of December 1783. Persons skilled in mathematics were conveniently stationed with proper instruments to calculate the height, velocity, &c. of the balloon. The weight of the whole apparatus, including that of the two adventurers, was found to be $604\frac{1}{2}$ pounds, and the power of ascent when they set out was 20 pounds; so that the whole difference betwixt the weight of this balloon and an equal bulk of common air was 624 pounds. But the weight of common atmosphere displaced by the inflammable gas

Montgolfier's machines superseded by those filled with inflammable air.

Experiment of Messrs Charles and Roberts.

In what manner the balloon partly filled with inflammable air lost power in their balloon.

First aerial voyage of Messrs Charles and Roberts.

cause of the weight of the latter; and this calculation makes it only $5\frac{1}{2}$ times lighter than common air.

At the time the balloon left the ground, the thermometer stood at 59° of Fahrenheit's scale; and the quicksilver in the barometer at 30.18 inches; and, by means of the power of ascent with which they left the ground, the balloon rose till the mercury fell to 27 inches, from which they calculated their height to be about 600 yards. By throwing out ballast occasionally as they found the machine descending by the escape of some of the inflammable air, they found it practicable to keep at pretty near the same distance from the earth during the rest of their voyage; the quicksilver fluctuating between 27 and 27.65 inches, and the thermometer between 53° and 57° , the whole time. They continued in the air for the space of an hour and three quarters, when they alighted at the distance of 27 miles from Paris: having suffered no inconvenience during their voyage, nor experienced any contrary currents of air, as had been felt by Mess. Pilatre and Arlandes.

As the balloon still retained a great quantity of inflammable gas, M. Charles determined to take another voyage by himself. M. Robert accordingly got out of the boat, which was thus lightened by 130 pounds, and of consequence the aerostatic machine now had nearly as much power of ascent. Thus he was carried up with such velocity, that in twenty minutes he was almost 9000 feet high, and entirely out of sight of terrestrial objects. At the moment of his parting with the ground, the globe had been rather flaccid; but it soon began to swell, and the inflammable air escaped from it in great quantity through the silken tube. He also frequently drew the valve that it might be the more freely emitted, and the balloon effectually prevented from bursting. The inflammable gas being considerably warmer than the external air, diffused itself all round, and was felt like a warm atmosphere; but in ten minutes the thermometer indicated a variation of temperature as great as that between the warmth of spring and the ordinary cold of winter. His fingers were benumbed by the cold, and he felt a violent pain in his right ear and jaw, which he ascribed to the dilatation of the air in these organs, as well as to the external cold. The beauty of the prospect which he now enjoyed, however, made amends for these inconveniences. At his departure the sun was set on the valleys; but the height to which M. Charles was got in the atmosphere, rendered him again visible, though only for a short time. He saw, for a few seconds, vapours rising from the valleys and rivers. The clouds seemed to ascend from the earth, and collect one upon the other, still preserving their usual form; only their colour was gray and monotonous for want of sufficient light in the atmosphere. By the light of the moon, he perceived that the machine was turning round with him in the air; and he observed that there were contrary currents which brought him back again. He observed also, with surprise, the effects of the wind, and that the streamers of his banners pointed upwards; which, he says, could not be the effect either of his ascent or descent, as he was moving horizontally at the time. At last, recollecting his promise of returning to his friends in half an hour, he pulled the valve, and

accelerated his descent. When within 200 feet of the earth, he threw out two or three pounds of ballast, which rendered the balloon again stationary; but, in a little time afterwards, he gently alighted in a field about three miles distant from the place whence he set out; though, by making allowance for all the turnings and windings of the voyage, he supposes that he had gone through nine miles at least. By the calculations of M. de Meunier, he rose at this time not less than 10,500 feet high; a height somewhat greater than that of Mount *Ætna*. A small balloon, which had been sent off before the two brothers set out on their voyage, took a direction opposite to that of the large one, having met with an opposite current of air, probably at a much greater height.

The subsequent aerial voyages differ so little from that just now related, that any particular description of them seems to be superfluous. It had occurred to Mr Charles, however, in his last flight, that there might be a possibility of directing the machine in the atmosphere; and this was soon attempted by M. Jean Pierre Blanchard, a gentleman who had, for several years before, amused himself with endeavours to fly by mechanical means, though he had never succeeded in the undertaking. As soon as the discovery of the aerostatic machines was announced, however, he resolved to add the wings of his former machine to a balloon, and made no doubt that it would then be in his power to direct himself through the air at pleasure. In his first attempt he was frustrated by the impetuosity of a young gentleman, who insisted, right or wrong, on ascending along with him. In the scuffle which ensued on this occasion, the wings and other apparatus were entirely destroyed; so that M. Blanchard was obliged to commit himself to the direction of the wind; and in another attempt it was found, that all the strength he could apply to the wings was scarce sufficient to counteract the impression of the wind in any degree. In his voyage, he found his balloon, at a certain period, acted upon by two contrary winds; but, on throwing out four pounds of ballast, he ascended to a place where he met with the same current he had at setting out from the earth. His account of the sensations he felt during this voyage, was somewhat different from that of M. Charles; having, in one part of it, found the atmosphere very warm, in another cold; and having once found himself very hungry, and at another time almost overcome by a propensity to sleep. The height to which he arose, as measured by several observations with mathematical instruments, was thought to be very little less than 10,000 feet; and he remained in the atmosphere an hour and a quarter.

The attempts of M. Blanchard to direct his machine through the atmosphere, were repeated in the month of April 1784 by Mess. Morveau and Bertrand, at Dijon, who raised themselves with an inflammable air balloon to the height, as it was thought, of 13,000 feet; passing through a space of 18 miles in an hour and 25 minutes. M. Morveau had prepared a kind of oars for directing the machine through the air; but they were damaged by a gust of wind, so that only two of them remained serviceable; by working these, however, they were able to produce a sensible effect on the motion of the machine. In a third aerial voyage performed by M. Blanchard, he seemed to pro-

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duce some effect by the agitation of his wings, both in ascending, descending, moving sidewise, and even in some measure against the wind; however, this is supposed, with some probability, to have been a mistake, as, in all his succeeding voyages, the effects of his machinery could not be perceived.

Second
voyage of
Messrs
Charles and
Robert.

The success of Messrs Charles and Robert in their former experiments, encouraged them soon to repeat them, with the addition of some machinery to direct their course. Having enlarged their former balloon to the size of an oblong spheroid $46\frac{1}{2}$ feet long and $27\frac{1}{2}$ in diameter, they made it to float with its longest part parallel to the horizon. The wings were made in the shape of an umbrella without the handle, to the top of which a stick was fastened parallel to the aperture of the umbrella. Five of these were disposed round the boat, which was near 17 feet in length. The balloon was filled in three hours, and, with the addition of 450 pounds of ballast, remained in *aequilibrio* with the atmosphere. About noon, on the 19th of September 1784, they began to ascend very gently in consequence of throwing out 24 pounds of ballast, but were soon obliged to throw out eight pounds more, in order to avoid running against some trees. Thus they rose to the height of 1400 feet, when they perceived some thunder clouds near the horizon. On this they ascended and descended, to avoid the danger, as the wind blew directly towards the threatening clouds; but, from the height of 600 feet to that of 4200 above the surface of the earth, the current was quite uniform and in one direction. During their voyage they lost one of their oars; but found, that by means of those which remained, they considerably accelerated their course. From the account of their voyage, it would seem that they had passed safely through the thunder clouds; as we are informed, that, about 40 minutes after three, they heard a loud clap of thunder; and three minutes after, another much louder; at which time the thermometer sunk from 77 to 59 degrees. This sudden cold, occasioned by the approach of the clouds, condensed the inflammable air so that the balloon descended very low, and they were obliged to throw out 40 pounds of ballast; yet on examining the heat of the air within the balloon, they found it to be 104° , when that of the external atmosphere was only 63° . When they had got so high that the mercury in the barometer stood only at 23.94 inches, they found themselves becalmed; so that the machine did not go even at the rate of two feet in a second, though it had before gone at the rate of 24 feet in a second. On this they determined to try the effect of their oars to the utmost; and, by working them for 35 minutes, and marking the shadow of the balloon on the ground, they found, in that time, that they had described the segment of an ellipsis whose longest diameter was 6000 feet. After having travelled about 150 miles, they descended, only on account of the approach of night, having still 200 pounds of ballast left.

Are in danger of running into thunder clouds.

Heat of the air within their balloon.

Effect of their oars in moving the machine.

Their conclusion, with regard to the effect of their wings, is as follows: "Those experiments show, that far from going against the wind, as is said by some persons to be possible in a certain manner, and some aeronauts pretend to have actually done, we only obtained, by means of two oars, a deviation of 22 degrees: it is certain, however, that if we could have

used our four oars, we might have deviated about 40 degrees from the direction of the wind; and as our machine would have been capable of carrying seven persons, it would have been easy for five persons to have gone, and to have put in action eight oars, by means of which a deviation of about 80 degrees would have been obtained.

"We have already observed (say they), that if we did not deviate more than 22 degrees, it was because the wind carried us at the rate of 24 miles an hour; and it is natural to judge, that if the wind had been twice as strong as it was, we should not have deviated more than one-half of what we actually did; and on the contrary, if the wind had been only half as strong, our deviation would have been proportionably greater."

Having thus related all that has been done with regard to the conducting of aerostatic machines through the atmosphere, we shall now relate the attempts that have been made to lessen their expence, by falling upon some contrivance to ascend without throwing out inflammable air. The first attempt of this kind was made by the duke de Chartres; who, on the 15th of July 1784, ascended with the two brothers, Roberts, and a fourth person, from the park of St Cloud. The balloon was of an oblong form, made to ascend with its longest diameter horizontally, and measured 55 feet in length and 24 in breadth. It contained within it a smaller balloon filled with common air; by blowing into which with a pair of bellows, and thus throwing in a considerable quantity of common air, it was supposed that the machine would become sufficiently heavy to descend, especially, as, by the inflation of the internal bag, the inflammable air in the external one would be condensed into a smaller space, and thus become specifically heavier. The voyage, however, was attended with such circumstances as rendered it impossible to know what would have been the event of the scheme. The power of ascent with which they set out, seems to have been very great; as, in three minutes after parting with the ground, they were lost in the clouds, and involved in such a dense vapour that they could see neither the sky nor the earth. In this situation they seemed to be attacked by a whirlwind, which, besides turning the balloon three times round from right to left, shocked and beat it so about, that they were rendered incapable of using any of the means proposed for directing their course, and the silk stuff of which the helm had been composed was even torn away. No scene can be conceived more terrible than that in which they were now involved. An immense ocean of shapeless clouds rolled one upon another below them, and seemed to prevent any return to the earth, which still continued invisible, while the agitation of the balloon became greater every moment. In this extremity they cut the cords which held the interior balloon, and of consequence it fell down upon the aperture of the tube that came from the large balloon into the boat, and stopped it up. They were then driven upwards by a gust of wind from below, which carried them to the top of that stormy vapour in which they had been involved. They now saw the sun without a cloud; but the heat of his rays, with the diminished density of the atmosphere, had such an effect on the inflammable air, that the balloon seemed every

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air.
Voyage of the duke de Chartres.

Is involved in dark clouds and attacked by a whirlwind.

every moment ready to burst. To prevent this, they introduced a stick through the tube, in order to push away the inner balloon from its aperture; but the expansion of the inflammable air pushed it so close, that all attempts of this kind proved ineffectual. It was now, however, become absolutely necessary to give vent to a very considerable quantity of the inflammable air; for which purpose the duke de Chartres himself bored two holes in the balloon, which tore open for the length of seven or eight feet. On this they descended with great rapidity; and would have fallen into a lake, had they not hastily thrown out 60 pounds of ballast, which enabled them just to reach the water's edge.

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The success of the scheme for raising or lowering aerostatic machines by means of bags filled with common air being thus rendered dubious, another method was thought of. This was to put a small aerostatic machine with rarefied air under an inflammable air balloon, but at such a distance that the inflammable air of the latter might be perfectly out of the reach of the fire used for inflating the former; and thus, by increasing or diminishing the fire in the small machine, the absolute weight of the whole would be considerably diminished or augmented. The scheme was unhappily put in execution by the celebrated M. Pilatre de Rozier, and another gentleman named M. Romaine. Their inflammable air balloon was about 37 feet in diameter, and the power of the rarefied air one was equivalent to about 60 pounds. They ascended without any appearance of danger or sinister accident: but had not been long in the atmosphere when the inflammable air balloon was seen to swell very considerably, at the same time that the aeronauts were observed, by means of telescopes, very anxious to get down, and busied in pulling the valve and opening the appendages to the balloon, in order to facilitate the escape of as much inflammable air as possible. A short time after this the whole machine was on fire, when they had then attained the height of about three quarters of a mile from the ground. No explosion was heard; and the silk which composed the air balloon continued expanded, and seemed to resist the atmosphere for about a minute; after which it collapsed, and the remains of the apparatus descended along with the two unfortunate travellers so rapidly, that both of them were killed. M. Pilatre seemed to have been dead before he came to the ground; but M. Romaine was alive when some persons came up to the place where he lay, though he expired immediately after.

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These are the most remarkable attempts that have been made to improve the science of aerostation; though a great number of other expeditions through the atmosphere have taken place. But of all the voyages which had been hitherto projected or put in execution, the most daring was that of M. Blanchard and Dr Jeffries across the straits of Dover, which separate Britain from France. This took place on the 7th of January 1785, being a clear frosty morning with a wind, barely perceptible, at N. N. W. The operation of filling the balloon began at 10 o'clock, and, at three quarters after 12, every thing was ready for their departure. At one o'clock M. Blanchard desired the boat to be pushed off, which now stood only two feet distant from that precipice so finely described by Shakespeare in his tragedy of King Lear. As the balloon

was scarcely sufficient to carry two, they were obliged to throw out all their ballast except three bags of 10 pounds each; when they at last rose gently; though making very little way on account of there being so little wind. At a quarter after one o'clock, the barometer, which on the cliff stood at 29.7 inches, was now fallen to 27.3, and the weather proved fine and warm. They had now a most beautiful prospect of the south coast of England, and were able to count 37 villages upon it. After passing over several vessels, they found that the balloon, at 50 minutes after one, was descending, on which they threw out a sack and a half of ballast; but as they saw that it still descended, and with much greater velocity than before, they now threw out all the ballast. This still proving ineffectual, they next threw out a parcel of books they carried along with them, which made the balloon ascend, when they were about midway between France and England. At a quarter past two, finding themselves again descending, they threw away the remainder of their books, and, ten minutes after, they had a most enchanting view of the French coast. Still, however, the machine descended; and as they had now no more ballast, they were obliged to throw away their provisions, the wings of their boat, and every thing they could possibly spare. "We threw away (says Dr Jeffries) our only bottle, which, in its descent cast out a steam like smoke, with a rushing noise; and when it struck the water, we heard and felt the shock very perceptibly on our car and balloon." All this proving insufficient to stop the descent of the balloon, they next threw out their anchors and cords, and at last stripped off their clothes, fastening themselves to certain slings, and intending to cut away the boat as their last resource. They had now the satisfaction, however, to find that they were rising; and as they passed over the high lands between Cape Blanc and Calais the machine rose very fast, and carried them to a greater height than they had been at any former part of their voyage. They descended safely among some trees in the forest of Guennes, where there was just opening enough to admit them.

It would be tedious as well as unnecessary to recount all the other aerial voyages that have been performed in our own or other countries: It appeared sufficient for the purpose of this article to notice those which were most remarkable and interesting; and therefore an account of the ingenious Mr Baldwin's excursion from Chester, alluded to above, must not be omitted in our enumeration.

On the 8th of September 1785, at forty minutes past Baldwin's one P. M. Mr Baldwin ascended from Chester in Mr voyage. Lunardi's balloon. After traversing in a variety of different directions, he first alighted, at 28 minutes after three, about twelve miles from Chester, in the neighbourhood of Frodsham; then reascending and pursuing his excursion, he finally landed at Rixton moss, five miles N. N. E. of Wavington, and 25 miles from Chester. Mr Baldwin has published his Observations and remarks made during his voyage, and taken from minutes. Our limits will not admit of relating many of his observations; but the few following are some of the most important and curious. "The sensation of ascending is compared to that of a strong pressure from the bottom of the car upwards against

View from
the balloon.

the soles of his feet. At the distance of what appeared to him seven miles from the earth, though by the barometer scarcely a mile and a half, he had a grand and most enchanting view of the city of Chester and its adjacent places below. The river Dee appeared of a red colour; the city very diminutive; and the town entirely blue. The whole appeared a perfect plain, the highest building having no apparent height, but reduced all to the same level; and the whole terrestrial prospect appeared like a coloured map. Just after his first ascent, being in a well watered and maritime part of the country, he observed a remarkable and regular tendency of the balloon towards the sea; but shortly after rising into another current of air, he escaped the danger: this upper current, he says, was visible to him at the time of his ascent, by a lofty sound stratum of clouds flying in a safe direction. The perspective appearance of things to him was very remarkable. The lowest bed of vapour that first appeared as cloud was pure white, in detached fleeces, increasing as they rose: they presently coalesced, and formed, as he expresses it, a sea of cotton, tufting here and there by the action of the air. In the undisturbed part of the clouds, the whole became an extended white floor of cloud, the upper surface being smooth and even. Above this white floor he observed, at great and unequal distances, a vast assemblage of thunder clouds, each parcel consisting of whole acres in the densest form: he compares their form and appearance to the smoke of pieces of ordnance, which had consolidated as it were into masses of snow, and penetrated through the upper surface or white floor of common clouds, there remaining visible and at rest. Some clouds had motions in slow and various directions, forming an appearance truly stupendous and majestic." He endeavours to convey some idea of the scene by a figure; (and from this fig. 1. Plate II. is copied). *A* represents a circular view he had from the car of the balloon, himself being over the centre of the view, looking down on the white floor of clouds, and seeing the city of Chester through an opening, which discovered the landscape below, limited by surrounding vapour to less than two miles in diameter. The breadth of the outer margin defines his apparent height in the balloon (*viz.* 4 miles) above the white floor of clouds. Mr Baldwin also gives a curious description of his tracing the shadow of the balloon over tops of volumes of clouds. At first it was small, in size and shape like an egg; but soon increased to the magnitude of the sun's disc, still growing larger, and attended with a most captivating appearance of an iris encircling the whole shadow at some distance round it, the colours of which were remarkably brilliant. The regions did not feel colder, but rather warmer than below. The sun was hottest to him when the balloon was stationary. The discharge of a cannon, when the balloon was at a considerable height, was distinctly heard by the aeronaut; and a discharge from the same piece, when at the height of thirty yards, so disturbed him as to oblige him for safety to lay hold firmly of the cords of the balloon. At a considerable height he poured down a pint bottle full of water; and as the air did not oppose a resistance sufficient to break the steam into small particles, it mostly fell down in large drops. In the course of the balloon's track it was found much affected by the water (a circumstance ob-

Appear-
ance of the
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served in former aerial voyages). At one time the direction of the balloon kept continually over the water, going directly towards the sea, so much as to endanger the aeronaut; the mouth of the balloon was opened, and in two minutes he descended into an under current blowing from the sea: he kept descending, and landed at Bellair farm in Rinsley, 12 miles from Chester. Here he lightened his car by 31 pounds, and instantly reascending, was carried into the interior part of the country, performing a number of different manœuvres. At his greatest altitude he found his respiration free and easy. Several bladders which he had along with him crackled and expanded very considerably. Clouds and land, as before, appeared on the same level. By way of experiment, he tried the upper valve two or three times, the neck of the balloon being close: and remarked, that the escape of the gas was attended with a growling noise like millstones, but not near so loud. Again, round the shadow of the balloon, on the clouds he observed the iris. A variety of other circumstances and appearances he met with, is fancifully described; and at 53 minutes past three he finally landed.

The following is an account of an establishment formed in France during the late war for the improvement of aerial navigation:

"The aerostatic institute, founded by the committee of public safety, and enveloped in the most profound secrecy at Meudon, to which also was added a camp for the exercise of the artillery, is even yet looked upon as a secret arrangement of the republic, respecting which the greatest precautions are taken; the doors being shut against the public and all foreigners.

It was impossible to have selected a more convenient spot for the establishment of the aeronautic institute than the royal lodge of Meudon. From its elevated site on a mountain, it commands a beautiful and extensive prospect over a plain covered with villages and cultivated fields, intersected by the Seine, and terminated by the city of Paris.

The perfection and the rational application of aeronautics are the objects of the labours of this establishment, to which the celebrated natural philosopher Guyton Morveau has in particular rendered the most important services. But the institution stood in need of such a director as Conté, for whom Guyton Morveau has procured the appointment. With a love of the science Conté unites a penetrating genius for research and invention, accompanied by indefatigable assiduity.

The corps of aeronauts, intended to serve in the armies of the republic, and consisting of fifty courageous youths, is trained at the school of Meudon: it is there the balloons are prepared which are sent off to the armies; and every day in summer the pupils are employed, at one time in performing their exercises, at another in making researches, in natural philosophy, with a balloon which is kept constantly filled for the purpose.

The improvement in the preparation of the balloon, the discovery of a new mode of filling it with inflammable air from the substance of water (hydrogen gas), discovered by Lavoisier, the invention of a new telegraph, connected with the balloon, are the principal advances which have been made in aerostatics at Meudon under the direction of Conté.

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The old lodge of Meudon serves as a manufactory for the preparation of the balloons, and of all the apparatus necessary to accompany them to the armies. The new lodge is appropriated to the institute, and to the accommodation of the pupils, and of the director and his family. There were prepared the *Entreprenant* for the army of the north, by means of which the hostile army was reconnoitred at the battle of Fleurus; the *Cleste* for the army of the Sambre and Maese; the *Hercule* and the *Intrepide* for the army of the Rhine and Moselle.

The silk for the balloons is manufactured at Lyons. and is very thick and strong: and Conté has rendered them much more durable by the precaution of only varnishing the outer surface. The varnish is of an excellent quality; it sufficiently hardens the outside, and does not make the silk stick together when the balloon is folded. Moreover, experience has proved that the inner coat of varnish cannot resist the operation of filling the balloon, that it is corroded by the gas, and that this friction renders the silk flabby.

The filling of the balloon with hydrogen gas is the result of the discoveries made by the great Lavoisier, and has for its basis his important experiment of the decomposition of water. The gas is prepared by the following simple and unexpensive process.

Six or more hollow iron cylinders are set in brick work, beside and over each other, in a furnace which may be constructed in twelve hours; and both ends of each cylinder are made to project from the furnace. The openings of these cylinders are stopped with strong iron covers, through which metal tubes are let in. The tube at one end serves for pouring water, previously heated, into the cylinders when red hot; that on the opposite side is destined to conduct the air which first presents itself, through a reservoir filled with a caustic lixivium, and to convey it into the balloon. The cylinders are partly filled with coarse iron filings, which the excessive heat of the furnace, kept up with pit coal during the whole time of the operation, reduces to a state of excandescence. At this stage of the process, the valve of one of the tubes of each cylinder is opened, and a small quantity of boiling water is gently poured into the heated cylinder. As soon as the vapour of the water touches the heated iron, the two substances which compose the water are separated: the one (the oxygen) attaches itself to the iron, which it calcines, and which after the operation, is found partly crystallized, after the manner of volcanic productions: the other of the component substances of the water (the hydrogen) combines with a quantity of the igneous substance termed *calorique*, and becomes inflammable air (hydrogen gas), which continues in a permanent state of elastic fluidity, and weighs seven or eight times less than the atmospheric air.

As the water contains a small portion of the substance of *carbone* (*carbonique*) which would render the air in the balloon heavy, the air, as it first rushes out of the cylinders, is made to pass through a reservoir of water impregnated with a caustic alkali. This fluid attracts to itself all the *carbonique*, and nothing rises into the balloon but very pure and inflammable air.

During the operation, it has sometimes happened that the cylinders, heated to excandescence, melted. To guard against this accident, the projecting end of the

cylinder is furnished with a pyrometer, and a scale, which, by means of an iron rod, indicates the degrees of rarefaction of the air. A particular point on the scale announces the moment when the cylinders are heated in the degree nearest to fusion: when such is the case, the fire is immediately diminished. The operation of filling a balloon of thirty feet diameter employs one-third of a day.

The exercising balloon at Meudon is of a spherical form, and thirty-two feet in diameter. Its upper half is covered with a linen case to keep off the rain from the balloon and its netting. This netting, woven with strong cords, embraces the upper part of the balloon, and is destined to support the car for the reception of the aeronauts. The balloon, kept constantly full and ready for ascent, and exposed in the open air in all weathers, preserves its buoyant station in the atmosphere, being fastened on the great terrace of the lodge. When the weather is favourable, the aeronautic exercises are begun. The balloon is set free from its fastenings, and elevated to a certain height; when the car is made fast to the cords which hang down from the net: the whole of this is done in five minutes. A colonel then mounts the car with one of the pupils, and the balloon rises to the height, generally, of from a hundred and sixty to two hundred and forty yards. The pupils separate into divisions, for the purpose of holding the balloon in the air, suffering it to mount, and drawing it down, by means of three principal ropes fastened to the net, and ramified with several others: in these manœuvres they employ the aid of a capstern. When the balloon has been newly filled, has yet suffered no evaporation, and still retains all its force, it requires the strength of twenty persons to hold it; and in that state it will bear eight hundred weight. After a space of two months, though much evaporated, it is still capable of bearing two persons with their instruments, and even a considerable ballast; at the same height in the air: but then ten persons are sufficient to hold it.

The car is constructed of a light lattice work of wood, lined with prepared leather, and hangs about sixteen feet beneath the balloon: it affords convenient room for two persons seated opposite each other, with the necessary instruments for making observations.

The balloon ascends as often in the day as is requisite for the succession of observations which are to be made; but these ascents take place only in calm and serene weather. Whenever any unforeseen accident occurs, the aerial machine is hauled down in five minutes. In strong gusts of wind which suddenly arise, the aeronauts are always exposed to some danger: the balloon, held by the ropes, cannot rise freely; and its vibrations and fluctuations resemble those of a paper kite which has not yet reached a certain degree of altitude. This spectacle, nevertheless, is more terrific to the spectator than to the aeronaut, who, seated in his car, which its own weight preserves in a perpendicular position under the balloon, is but slightly affected by its desultory motion. No instance of any unfortunate accident has yet occurred at Meudon.

All fear, all idea of danger, vanishes on examining the solidity of the whole apparatus, the precautionary measures adopted with the most prudent foresight and the utmost security, and especially when we are more particularly

de of
paring
bal-
28.

gas.

Exercises
of the
pupils.

Form of the
car.

particularly acquainted with the cool unassuming steadiness of Conté, the director of the whole.

When the return of peace shall allow more leisure, and shall favour the employment of this apparatus in other experiments than those immediately connected with the military service, we may expect to derive from it the most important and diversified advantages to natural science. The experiments will then be conducted under the direction of a committee of naturalists from the national institute, with a view of making discoveries in natural philosophy, meteorology, and other branches. When the labours of the aerostatic institute shall have accomplished ends so important to the arts, and of so great general utility, there will be printed a particular account of the establishment, and of the course of experiments pursued: at present, these matters are kept from the knowledge of the public.

Utility of
aerostatic
experi-
ments.

Aerostatic
telegraph.

The most recent invention of Conté, admirable for its simplicity and precision, is the aerostatic telegraph. It consists of eight cylinders of varnished black silk, stretched on hoops, and resembling those little pocket lanterns of crimped paper, which draw out and fold down again on themselves. These eight moveable cylinders, each three feet in diameter, and of a proportionate length, are suspended from the bottom of the car, connected together with cords, and hanging one above another, at the distance of four feet. By means of cords passing through the bottom of the car, the aeronautic observers direct those cylinders, give them different positions at will, and thus carry on their telegraphic correspondence from the regions of the air.

Conté has further applied his thoughts to the invention of a similar aerostatic telegraph, which, without the assistance of a great balloon, or an aerial correspondent, should be managed by a person standing on the ground, by means of cords; the apparatus being suspended to a small balloon, of only twelve feet diameter.

Ascent of a
balloon at
the battle of
Fleurus.

Coutel, captain of the aeronautic corps, was the man who ascended with the *Entreprenant* balloon on the 26th of June, 1794, and who conducted the wonderful and important service of reconnoitring the hostile armies at the battle of Fleurus, accompanied by an adjutant and a general. He ascended twice on that day, to observe, from an elevation of four hundred and forty yards, the position and manœuvres of the enemy. On each occasion he remained four hours in the air, and, by means of preconcerted signals with flags, carried on a correspondence with General Jourdan, the commander of the French army.

His intended ascent had been made known to the enemy, who, at the moment when the balloon began to take its flight, opened the fire of a battery against the aeronauts. The first volley was directed too low: one ball, nevertheless, passed between the balloon and the car, and so near to the former, that Coutel imagined it had struck it. When the subsequent discharges were made, the balloon had already reached such a degree of altitude, as to be beyond the reach of cannon shot, and the aeronauts saw the balls flying beneath the car. Arrived at their intended height, the observers, remote from danger, and undisturbed, viewed all the evolutions of their enemies, and, from the peaceful regions of the air, commanded a distinct and com-

prehensive prospect of two formidable armies engaged in the work of death." (*Month. Mag.* vol. vi. p. 337.)

On the 28th of June 1802, M. Garnerin, a French aeronaut, in company with an English gentleman, ascended in a balloon of 20 feet diameter from Ranelagh gardens. They passed over London, rose to the height of 10,000 feet, and landed in three quarters of an hour from the time of their ascent on a common near Colchester, a distance of near 60 miles from London. The temperature of the air when they ascended to the clouds was 15 degrees lower than on the surface of the earth; but when they rose above the clouds, it became sensibly milder. The rapidity of M. Garnerin's voyage is unequalled in the history of aerostation.

Garnerin's
voyage in
England
remarkable
for its rapidity.

The frequency of aerial voyages, accompanied with particular details of trifling and uninteresting circumstances, and apparently made with a view to promote the interests of particular persons, regardless of any advancement in knowledge, had sunk the science of aerostation so low in the opinion of most people, that before we give an account of the most proper methods of constructing these machines, it is necessary to premise something concerning the uses to which they may possibly be applied. These, according to Mr Cavallo, are the following:—

Uses of
aerostation.

"The small balloons, especially those made of paper, and raised by means of spirit of wine, may serve to explore the direction of the winds in the upper regions of the atmosphere, particularly when there is a calm below; they may serve for signals in various circumstances, in which no other means can be used; and letters or other small things may be easily sent by them, as for instance from ships that cannot safely land on account of storms, from besieged places, islands, or the like. The larger aerostatic machines may answer all the above mentioned purposes in a better manner; and they may, besides, be used as a help to a person who wants to ascend a mountain, a precipice, or to cross a river; and perhaps one of these machines tied to a boat by a long rope, may be, in some cases, a better sort of sail than any that is used at present. The largest sort of machines, which can take up one or more men, may evidently be subservient to various economical and philosophical purposes. Their conveying people from place to place with great swiftness, and without trouble, may be of essential use, even if the art of guiding them in a direction different from that of the wind should never be discovered. By means of those machines the shape of certain seas and lands may be better ascertained; men may ascend to the tops of mountains they never visited before; they may be carried over marshy and dangerous grounds; they may by that means come out of a besieged place, or an island; and they may, in hot climates, ascend to a cold region of the atmosphere, either to refresh themselves, or to observe the ice, which is never seen below; and, in short, they may be thus taken to several places, to which human art hitherto knew of no conveyance.

"The philosophical uses, to which these machines may be subservient, are numerous indeed: and it may be sufficient to say, that hardly any thing which passes in the atmosphere is known with precision, and that principally for want of a method of ascending into it. The formation of rain, of thunder storms, of vapours, hail,

hail, snow, and meteors in general, require to be attentively examined and ascertained. The action of the barometer, the refraction and temperature of the air in various regions, the descent of bodies, the propagation of sound, &c. are subjects which all require a series of observations and experiments, the performance of which could never have been properly expected before the discovery of aerostatic machines."

To these uses we may add the gratification of curiosity and pleasure, as a very strong inducement to the practice of an art, in which, with any tolerable degree of caution, there appears not to be the smallest danger. Every one who has tried the experiment testifies, that the beauty of the prospect afforded by an ascent, or the pleasure of being conveyed through the atmosphere, cannot be exceeded. No one has felt the least of that giddiness consequent upon looking from the top of a very high building or of a precipice, nor have they any of the sickness arising from the motion of a vessel at sea. Many have been carried by balloons at the rate of 30, 40, or even 50 miles an hour, without feeling the least inconvenience, or even agitation of the wind; the reason of which is, that as the machine moves with nearly the velocity of the wind itself, they are always in a calm, and without uneasiness. Some have apprehended danger from the electricity of the atmosphere; and have thought, that a stroke of lightning, or the smallest electric spark, happening near a balloon, might set fire to the inflammable air, and destroy both the machine and the adventurers. Mr Cavallo has suggested several considerations for diminishing apprehensions of this kind. Balloons have been already raised in every season of the year, and even when thunder has been heard, without injury. In case of danger, the aeronauts may either descend to the earth, or ascend above the region of the clouds and thunder storms. Besides, as balloons are formed of materials that are not conductors of electricity, they are not like to receive strokes, especially as by being encompassed with air, they stand insulated. Moreover, inflammable air by itself, or unmixed with a certain quantity of common air, will not burn; so that if an electric spark should happen to pass through the balloon, it would not set fire to the inflammable air, unless a hole was made in the covering.

The general principles of aerostation are so little different from those of hydrostatics, that it may seem superfluous to insist much upon them. It is a fact universally known, that when a body is immersed in any fluid, if its weight be less than an equal bulk of that fluid, it will rise to the surface; but if heavier, it will sink; and if equal, it will remain in the place where it is left. For this reason smoke ascends into the atmosphere, and heated air in that which is colder. The ascent of the latter is shown in a very easy and satisfactory manner by bringing a red-hot iron under one of the scales of a balance, by which the latter is instantly made to ascend; for as soon as the red-hot iron is brought under the scale, the hot air being lighter than that which is colder, ascends, and strikes the bottom, which is thus impelled upwards, and the opposite scale descends, as if a weight had been put into it.

Upon this simple principle depends the whole theory of aerostation; for it is the same thing whether we render the air lighter by introducing a quantity of

heat into it, or enclosing a quantity of gas specifically lighter than the common atmosphere in a certain space; both will ascend, and for the same reason. A cubic foot of air, by the most accurate experiments, has been found to weigh about 554 grains, and to be expanded by every degree of heat, marked on Fahrenheit's thermometer, about $\frac{1}{300}$ th part of the whole. By heating a quantity of air, therefore, to 500 degrees of Fahrenheit, we shall just double its bulk when the thermometer stands at 54 in the open air, and in the same proportion we shall diminish its weight; and if such a quantity of this hot air be enclosed in a bag, that the excess of the weight of an equal bulk of common air weighs more than the bag with the air contained in it, both the bag and air will rise into the atmosphere, and continue to do so until they arrive at a place where the external air is naturally so much rarefied that the weight becomes equal: and here the whole will float.

The power of hot air in raising weights, or rather that by which it is itself impelled upwards, may be shown in the following manner: Roll up a sheet of paper into a conical form, and, by thrusting a pin into it near the apex, prevent it from unrolling. Fasten it then, by its apex, under one of the scales of a balance by means of a thread, and, having properly counterpoised it by weights, put it into the opposite scale; apply the flame of a candle underneath, you will instantly perceive the cone to arise, and it will not be brought into equilibrium with the other but by a much greater weight than those who have never seen the experiment would believe. If we try this experiment with more accuracy, by getting proper receptacles made which contain determinate quantities of air, we shall find that the power of the heat depends much more on the capacity of the bag which contains it than could well be supposed. Thus, let a cubical receptacle be made of a small wooden frame covered with paper, capable of containing one foot of air, and let the power of a candle be tried with this as above directed for the paper cone. It will then be found that a certain weight may be raised; but a much greater one will be raised by having a receptacle of the same kind which contains two cubic feet; a still greater by one of three feet; a yet greater by one of four feet, &c. and this even though the very same candle be made use of; nor is it known to what extent even the power of this small flame might be carried.

From these experiments it appears, that in the aerostatic machines constructed on Montgolfier's plan, it must be an advantage to have them as large as possible; because a smaller quantity of fire will then have a greater effect in raising them, and the danger from that element, which in this kind of machine is chiefly to be dreaded, will be in a great measure avoided. On this subject it may be remarked, that as the cubical contents of a globe, or any other figure of which balloons are made, increase much more rapidly than their surfaces, there must ultimately be a degree of magnitude at which the smallest imaginable heat would raise any weight whatever. Thus, supposing any aerostatic machine capable of containing 500 cubic feet, and the air within it to be only one degree hotter than the external atmosphere; the tendency of this machine to rise, even without the application of artificial heat, would be

be near an ounce. Let its capacity be increased 16 times; and the tendency to arise will be equivalent to a pound, though this may be done without making the machine 16 times heavier than before. It is certain, however, that all aerostatic machines have a tendency to produce or preserve heat within them, which would by no means be imagined by those who have not made the experiment. When Messrs Charles and Roberts made their longest aerial voyage of 150 miles, they had the curiosity to try the temperature of the air within their balloon, in comparison with that of the external atmosphere; and at this time they found, that when the external atmosphere was 63° , the thermometer within the balloon stood at 104° . Such a difference of temperature must have given a machine of the magnitude which carried them a considerable ascending power independent of any other cause, as it amounted to 41 grains on every cubic foot; and therefore in a machine containing 50,000 such feet would have been almost 200 pounds. Hence we may easily account for what happened at Dijon, and is recorded by M. Morveau. "A balloon, intended to be filled with inflammable air, being completed, was, by way of trial, filled with common air, and in that state exposed to the atmosphere. Now it was observed, and indeed a similar observation had been made before, that the air within the balloon was much hotter than the circumambient air; the thermometer in the former stood at 120° ; whereas in the latter, even when the sun shone upon it, the thermometer stood at 84° . This showed a considerable degree of rarefaction within the balloon; and consequently it was suspected, that, by means of this rarefaction alone, especially if it were to increase a little, the balloon might ascend. On the 30th of May, about noon, the wind being rather strong, agitated the balloon so that two men were employed to take care of it; but, notwithstanding all their endeavours, it escaped from its confinement; and, lifting up about 65 pounds weight of cords, equatorial circle, &c. rose many feet high, and passing over some houses, went to the distance of 250 yards, where at length it was properly secured."

A balloon at Dijon rises thus into the atmosphere.

Internal heat of the balloons has great influence on aerial voyages.

This difference between the external and internal heat being so very considerable, must have a great influence upon aerostatic machines, and will undoubtedly influence those filled with inflammable air as well as the other kind. Nor is it unlikely, that the short time which many aerial voyagers have been able to continue in the atmosphere may have been owing to the want of a method of preserving this internal heat. It may naturally be supposed, and indeed it has always been found, that balloons, in passing through the higher regions of the atmosphere, acquire a very considerable quantity of moisture, not only from the rain or snow they sometimes meet with, but even from the dew and vapour which condenses upon them. On this an evaporation will instantly take place; and, as it is the property of this operation to produce a very violent cold, the internal heat of the balloon must be soon exhausted in such a manner as to make it become specifically heavier than the common atmosphere, and consequently descend in a much shorter time than it would have done by the mere loss of air. To this, in all probability, we are to ascribe the descent of the balloon which carried Messrs Blanchard and Jeffries; and

which seemed so extraordinary to many people, that they were obliged to have recourse to an imaginary attraction in the waters of the ocean, in order to solve the phenomenon. This supposition is rejected by Mr Cavallo; who explains the matter, by remarking, that in two former voyages made with the same machine, it could not long support two men in the atmosphere; so that we had no occasion to wonder at its weakness on this occasion. "As for its rising higher (says he), just when it got over the land, that may be easily accounted for. In the first place, the two travellers threw out their clothes just about that time; secondly, in consequence of the wind's then increasing, the balloon travelled at a much greater rate than it had done whilst over the sea; which increase of velocity lessened its tendency to descend: besides which, the vicissitudes of heat and cold may produce a very considerable effect; for if we suppose, that the air over the land was colder than that over the sea, the balloon coming into the latter from the former, continued to be hotter than the circumambient air for some time after; and consequently, it was comparatively much lighter when in the cold air over the land, than when in the hotter air over the sea; hence it floated easier in the former than in the latter case."

It seems indeed very probable, that there was something uncommon in the case of M. Blanchard's balloon while passing over the sea; for, as it rose higher after reaching the land than in any former period of the voyage, and likewise carried them to a distance over land more than half of that which they had passed over water, we can scarce avoid supposing, that it had a tendency to descend when over the water more than when over land, independent of any loss of air. Now, it does not appear that the air over the sea is at all warmer than that above land; on the contrary, there is every reason to believe, that the superior reflective power of the land renders the atmosphere above it warmer than the sea can do: but it is very natural to suppose, that the air above the sea is more moist than that above land; and consequently, by letting fall its moisture upon the balloon, must have occasioned an evaporation that would deprive the machine of its internal heat, which it would partly recover after it entered the warmer and drier atmosphere over land.

We shall now proceed to the construction of aerostatic machines; of which the smaller are only for amusement, or some slight experiments, and are very easily made. As in all of them, however, it is of the utmost consequence to have the weight as little as possible, the shape becomes an object of great consideration. For this purpose a spherical figure has been mathematically demonstrated to be the best; as capable of containing a greater quantity under a smaller surface than any other. Thus a perfect sphere contains less surface in proportion to its solidity than a spheroid; a spheroid less than a cylinder; the latter less than a cube; and a cube still less than a parallelopiped. In all cases, therefore, where we can fill the whole capacity of the balloon with air equally light, the spherical figure is undoubtedly to be preferred: and this holds good with regard to all inflammable air balloons, whether their size be great or small; but in the rarefied air ones, where the under part must necessarily be much colder than the upper, the globular shape seems not so proper.

Construction of aerostatic machines.

Of their shape.

proper. An inverted cone, or truncated pyramid, with the smaller part undermost, seems then to be most proper, as it allows the heated air (which has a great tendency to expand as well as to ascend) to collect in the wide part at the top, while the useless surface, in the lower part, and which, in any other figure, would contain only the colder and heavier air, is thus thrown aside. In fact it has been found, that aerostatic machines, raised by means of rarefied air, when made of the shape of a parallelopiped, or even one deviating still more from the shape of a globe, have answered the purpose as well as they could have been supposed to do, had ever so much care been taken in forming them exactly to that shape. The very first machine made by M. Montgolfier was in form of a parallelopiped; and though it contained only 40 cubic feet, showed a very considerable power of ascent. A very large one, 74 feet high, which M. Montgolfier had designed to exhibit before the royal family, had the middle part of it prismatic for about the height of 25 feet; its top was a pyramid of 29 feet; and its lower part was a truncated cone of near 20 feet. It weighed 1000 pounds; and, notwithstanding its shape, in a very short time manifested a power of ascent equal to 500 pounds. Another aerostatic machine of a small size, but of the figure of a parallelopiped, being suffered to ascend with 30 sheets of oiled paper fixed in a wire frame, and set on fire, rose to a great height, and in 22 minutes could not be seen. It seems therefore, that, with regard to the shape of these machines, it is by no means necessary to adhere rigidly to that of a sphere; but that any oblong form answers very well.

erials.

For experimental purposes, both the inflammable and rarefied air balloons may be made of paper; the former being made of that kind called *thin post*, varnished over with linseed oil; the latter either of that or any other kind, without varnish. In order to avoid the danger of burning, however, it has been proposed to impregnate the paper of which these small rarefied air balloons are made with a solution of sal ammoniac, alum, or some other salt: but this does not seem to be necessary. Those filled with inflammable air have been made of gold-beaters skin or peeled bladders; but the cheaper material of paper is undoubtedly preferable.

var-
for in-
flammable
air.

For aerostatic machines of a larger size, the material universally employed is varnished silk; and for those of the rarefied air kind, linen painted over with some size colour, or lined with paper. The best varnish for an inflammable air balloon is that made with birdlime, and recommended by M. Faujas de Saint Fond, in a treatise published on the subject. The following is his method of preparing it: "Take one pound of birdlime, put it into a new proper earthen pot that can resist the fire, and let it boil gently for about an hour, viz. till it cease to crackle; or, which is the same thing, till it is so far boiled, as that a drop of it being let fall upon the fire will burn: then pour upon it a pound of spirit of turpentine, stirring it at the same time with a wooden spatula, and keeping the pot at a good distance from the flame, lest the vapour of this essential oil should take fire. After this, let it boil for about six minutes longer; and then pour upon the whole three pounds of boiling oil of nuts, linseed, or poppy, rendered drying by means of litharge; stir it well, let

it boil for a quarter of an hour longer, and the varnish is made. After it has rested for 24 hours, and the sediment has gone to the bottom, decant it into another pot; and when you want to use it, warm, and apply it with a flat brush upon the silk stuff, whilst that is kept well stretched. One coat of it may be sufficient; but if two are necessary, it will be proper to give one on each side of the silk, and to let them dry in the open air while the silk remains extended."

Mr Cavallo gives the following method of preparing this varnish, which he prefers to that of M. de St. lo's method.—"In order to render linseed oil drying, boil

it with two ounces of saccharum saturni and three ounces of litharge, for every pint of oil, till the oil has dissolved them, which will be accomplished in half an hour; then put a pound of birdlime and half a pint of the drying oil into a pot (iron or copper pots are the safest for this purpose), the capacity of which may be equal to about one gallon, and let it boil very gently over a slow charcoal fire till the birdlime ceases to crackle, which will be in about half or three quarters of an hour; then pour upon it two pints and a half more of drying oil, and let it boil for one hour longer, stirring it very frequently with an iron or wooden spatula. As the varnish, whilst boiling, and especially when it is nearly done, swells very much, care should be had to remove, in those cases, the pot from the fire, and to replace it when the varnish subsides, otherwise it will boil over. Whilst the stuff is boiling, the operator should, from time to time, examine whether the varnish has boiled enough; which is thus known:—Take some of it upon the blade of a knife, and then, after rubbing the blade of another knife upon it, separate the knives; and when, on this separation, the varnish begins to form threads between the two, you may conclude that it is done; and, without losing time, it must be removed from the fire. When it is almost, though not quite cold, add about an equal quantity of spirit of turpentine; mix it well together, and let it rest till the next day; when, having warmed it a little, strain and bottle it. If it is too thick, add some more spirit of turpentine. When this varnish is laid upon the silk, the stuff should be made perfectly dry, and stretched; so that the varnish, which ought to be used lukewarm, may fill up the pores of the stuff. The varnish should be laid once very thin upon one side of the stuff; and, about 12 hours after, two other coats of it should be laid on, one on each side; and, 24 hours after, the silk may be used, though, in cold weather, it may be left to dry some time longer."

Much has been said in France of their elastic gum varnish, and its composition kept a secret; but Mr Baldwin, after many expensive trials, declares to the world what he considers as the secret; and it is merely this: "Take any quantity of caoutchouc, as two ounces avoirdupois; cut it into small bits with a pair of scissors; put a strong iron ladle (like that used by plumbers) over a common pitcoal or other fire. The fire must be gentle, glowing, and without smoke. When the ladle is hot, much below a red heat, put a single bit into the ladle. If black smoke issues, it will presently flame and disappear, or it will evaporate without flame: the ladle is then too hot. When the ladle is less hot, put in a second bit, which will pro-

duce a *white* smoke. This *white* smoke will continue during the operation, and evaporate the caoutchouc: therefore no time is to be lost; but little bits are to be put in, a few at a time, till the whole are melted. It should be continually and gently stirred with an iron or brass spoon. Two pounds or one quart of the best drying oil (or of raw linseed oil, which together with a few drops of neats foot oil, has stood a month, or not so long, on a lump of quicklime, to make it more or less drying), is to be put into the melted caoutchouc, and stirred till hot, and the whole poured into a glazed vessel through a coarse gauze or fine sieve. When settled and clear, which will be in a few minutes, it will be fit for use either hot or cold." Mr Baldwin is not at liberty, he observes, to publish the art of laying on the varnish: but says, that it consists in making no *intestine motion* in the varnish, which would create minute bubbles; that therefore brushes are improper. M. Blanchard's method of making elastic gum varnish for the silk of a balloon, is the following. "Dissolve elastic gum (caoutchouc) cut small, in five times its weight of spirit of turpentine, by keeping them some days together; then boil one ounce of this solution in eight ounces of drying linseed oil for a few minutes; lastly, strain it. It must be used warm." The pieces of silk for the balloon must be cut out of a proper size, according to the dimensions, after the varnish is sufficiently dry. They may be joined by laying about half an inch of the edge of one piece over the edge of the other, and sewing them by a double stitching. M. Blanchard uses expeditiously the following method: He lays about half an inch of the edge of one piece flat over the edge of the other, and passes a hot iron over it; in doing which a piece of paper ought to be laid both under and over the silk. The joining may be rendered more secure by running it with a silk thread, and sticking a ribband over it. The ribbands laid over seams may be stuck with common glue, provided the varnish of the silk is properly dried. When the glue is quite dry, the ribbands should be varnished over, to prevent their being unglued by the rain.

Of cutting
the gores
for a globe.

The best method of cutting the pieces of silk that are to form a balloon, is to describe a pattern of wood or stiff card paper, and then to cut the silk upon it. As the edges of such a pattern are not perfect circles, they cannot be described by a pair of compasses; but the best method of drawing them is as follows. First, Draw on a flat surface two right lines AE and BC, fig. 2. perpendicular to each other. Secondly, Find the circumference answering to the given diameter of the balloon in feet and decimals of a foot; and make AD and DE each equal to a quarter of the circumference, so that the whole length AE of the pattern may be equal to half the circumference. Thirdly, Divide AD into 18 equal parts; and to the points of division apply the lines *fg*, *hi*, *kl*, &c. parallel to each other, and perpendicular to AD. Fourthly, Divide the whole circumference in twice the given number of pieces, and make DC and BB each equal to the quotient of this division: so that the whole, BC, is equal to the greatest breadth of one of these pieces. Fifthly, Multiply the above-mentioned quotient by the decimals annexed to *fg*, viz. 0.99619, and then the product expresses the length of *fg*; again, multiply the same length of DE by the decimals annexed to *hi*, and the product ex-

presses the length of *hi*; and, in short, the product arising from the multiplication of the length of DC by the decimals annexed to each of the parallel lines, gives the length of that line. Lastly, Having found the lengths of all these lines, draw by hand a curve line passing through all the extremities of the said lines, and that is the edge of one quarter of the pattern. The other quarters may be easily described, by applying to them a piece of paper cut according to that already found. Suppose, for example, that the diameter of the balloon to be constructed is 20 feet, and that it is required to make it of 12 pieces; then, in order to draw the pattern for those pieces, find the circumference of the balloon, which is 62.85 feet, and dividing it by four, the quotient is 15.7 feet; make therefore AD equal to 15.7 feet, and DE likewise of the same length. Divide the circumference 62.83 by 24, which is double the number of pieces that are to form the balloon, and the quotient, 2.618 feet, is the length of DC and likewise of BD; so that BC is equal to 5.236 feet. Then having divided the line AD into 18 equal parts, and having drawn the parallel lines from those points of division, find the length of each of those lines by multiplying 2.618 by the decimals annexed to that line. Thus, 2.618 multiplied by 0.99619, gives 2.608 feet for the length of *fg*; and again, multiplying 2.618 by 0.98481, gives 2.578 feet for the length of *hi*; and so of the rest. In cutting the pieces after such a pattern, care should be taken to leave them about three quarters of an inch all round larger than the pattern, which will be taken up by the seams.

To the upper part of the balloon there should be adapted, and well fitted in, a valve, opening inwards; to which should be fastened a string passing through a hole made in a small piece of round wood fixed in the lowest part of the balloon opposite to the valve, and the end of this string fastened in the car below, so that the aeronaut may open the valve when occasion requires. The action of this valve may be understood from fig. 3. A round brass plate AB has a round hole CD, about two or three inches diameter, covered on both sides with strong smooth leather. On the inside there is a shutter E, also of brass, covered with leather, which is to close the hole CD; being about two inches larger in diameter than the hole. It is fastened to the leather of the plate AB; and by a spring, which need not be very strong, it is kept against the hole. The elasticity of the gas itself will help to keep it shut. To this shutter the string is fastened, by which it is occasionally opened for the escape of gas. A small string or other security should be fixed to the shutter and the plate, so as not to admit the shutter to be opened beyond a certain safe distance. To the lower part of the balloon two pipes should be fixed, made of the same stuff as the envelope; 6 inches diameter for a balloon of 30 feet, and proportionably larger for balloons of a greater capacity. They must be long enough for the car. For balloons of 18 feet and less diameter, one neck or pipe will be sufficient. These pipes are the apertures through which the inflammable gas is introduced into the balloon.

The car or boat is best made of wicker work, covered with leather, and well painted or varnished over; and the proper method of suspending it, is by ropes proceeding

ceeding from the net which goes over the balloon. This net should be formed to the shape of the balloon, and fall down to the middle of it, with various cords proceeding from it to the circumference of a circle about two feet below the balloon; and from that circle other ropes should go to the edge of the boat. This circle may be made of wood, or of several pieces of slender cane bound together. The meshes of the net may be small at top, against which part of the balloon the inflammable air exerts the greatest force; and increase in size as they recede from the top. A hoop has sometimes been applied round the middle of the balloon to fasten the net. This, though not absolutely necessary, is best made of pieces of cane bound together, and covered with leather.

With regard to the rarefied air machines, Mr Cavallo recommends first to soak the cloth in a solution of sal-ammoniac and common size, using one pound of each to every gallon of water; and when the cloth is quite dry, to paint it over in the inside with some earthy colour, and strong size or glue. When this paint has dried perfectly, it will then be proper to varnish it with oily varnish, which might dry before it could penetrate quite through the cloth. Simply drying linseed oil will answer the purpose as well as any, provided it be not very fluid.

It now only remains to give some account of the method by which aerostatic machines may be filled with their proper gas, in order to give them their power of ascending into the atmosphere; and here we are enabled to determine with much greater precision concerning the inflammable air balloons than the others.

With regard to them, a primary consideration is, the most proper method of procuring the inflammable air. It may be obtained in various ways, as will be shown under the article CHEMISTRY. But the most advantageous methods are, by applying acids to certain metals; by exposing animal, vegetable, and some mineral substances, in a close vessel to a strong fire; or by transmitting the vapour of certain fluids through red-hot tubes.

1. In the first of these methods, iron, zinc, and sulphuric acid are the materials most generally used. The sulphuric acid must be diluted with five or six parts of water. Iron may be expected to yield in the common way 1700 times its own bulk of gas; or one cubic foot of inflammable air to be produced by $4\frac{1}{2}$ ounces of iron, the like weight of sulphuric acid, and $22\frac{1}{2}$ ounces of water. Six ounces of zinc, an equal weight of sulphuric acid, and 30 ounces of water, are necessary for producing the same quantity of gas. It is more proper to use the turnings or chippings of great pieces of iron, as of cannon, &c. than the filings of that metal, because the heat attending the effervescence will be diminished; and the diluted acid will pass more readily through the interstices of the turnings when they are heaped together, than through the filings, which stick closer to one another. The weight of the inflammable air thus obtained by means of sulphuric acid, is, in the common way of procuring it, generally one-seventh part of the weight of common air; but with the necessary precautions for philosophical experiments, less than one-tenth of the weight of common air. Two other sorts of elastic fluids are sometimes generated with the inflammable air. These

may be separated from it by passing the inflammable air through water in which quicklime has been dissolved. The water will absorb these fluids, cool the inflammable air, and prevent its over-heating the balloon when introduced into it.

Fig. 4. of Plate II. represents an apparatus described by Mr Cavallo as proper for filling balloons of the size of two or three feet in diameter with inflammable air, after passing it through water.—A is the bottle with the ingredients: BCD a tube fastened in the neck at B, and passing through C, the cork of the other bottle, in which there is another hole made to receive the tube on which the balloon is tied. Thus it is plain, that the inflammable air coming out of the tube D will pass first through the water of the bottle E and then into the balloon. Two small casks may be used instead of the bottles A and E.

2. Inflammable air may be obtained at a much cheaper rate by the action of fire on various substances; but the gas which these yield is not so light as that produced by the effervescence of acids and metals. The substances proper to be used in this way are, pitcoal, asphaltum, amber, rock-oil, and other minerals; wood, and especially oak, camphor-oil, spirits of wine, ether, and animal substances, which yield air in different degrees, and of various specific gravities: but pitcoal is the preferable substance. A pound of this exposed to a red heat, yields about three cubic feet of inflammable air, which, whether it be passed through water or not, weighs about one-fourth of the weight of common air. Dr Priestley found, as we have elsewhere noticed, that animal or vegetable substances will yield six or seven times more inflammable air when the fire is suddenly increased than when it is gently raised, though it be afterwards made very strong. Mr Cavallo observes, that the various substances above enumerated generally yield all their inflammable air in about one hour's time. The general method is, to enclose the substances in iron or earthen vessels, and thus expose them to a strong fire sufficient to make the vessels red-hot; the inflammable air proceeding from the aperture of the vessel is received into a tube or refrigeratory, and, passing through the tube or worm, is at last collected in a balloon or other vessel. A gun-barrel has often been used for essays of this kind. The substance is put into it so as to fill six or eight inches of its lowest part, the remainder filled with dry sand: a tube, adapted to the mouth of the barrel, is brought into a bason of water under an inverted receiver; and the part of the barrel containing the substance being put into the fire and made red-hot, the inflammable air is collected in the inverted receiver. As the gun-barrel cannot serve for producing a large quantity of inflammable air, Mr Cavallo recommends, as the most advantageous shape, the following contrivance: Let the vessel be made of clay, or rather of iron, in the shape of a Florence flask, somewhat larger, and whose neck is longer and larger (See ABC, fig. 5.). Put the substance to be used into this vessel, so as to fill about four-fifths or less of its cavity AB. If the substance is of such a nature as to swell much by the action of the fire, lute a tube of brass, or first a brass and then a leaden tube, to the neck C of the vessel; and let the end D of the tube be shaped as in the figure, so that going into the water of a tube HI, it may terminate under a sort of inverted ves-

sel EF, to the upper aperture of which the balloon G is adapted. Things thus prepared, if the part A B of the vessel is put into the fire, and made red hot, the inflammable air produced will come out of the tube CD, and passing through the water will at last enter into the balloon G. Previous to the operation, as a considerable quantity of common air remains in the inverted vessel EF, which it is more proper to expel, the vessel EF should have a stop-cock K, through which the common air may be sucked out, and the water ascend as high as the stop-cock. The dimensions of such an apparatus Mr Cavallo gives thus: Diameter of largest part of the vessel ABC seven inches, length of whole vessel 16 inches; diameter of its aperture one inch, diameter of the cavity of the tube CD three-fourths of an inch; lower aperture of the vessel EF six inches, least height of the vessel EF 24 inches; its aperture F about two inches. The aperture of the vessel EF should be at least one foot below the surface of the water in HI. Care must be taken that the fire used in this process be at a sufficient distance, otherwise it may happen to fire the inflammable air which may escape out of the vessel EF.

3. The last method of obtaining inflammable air was discovered by M. Lavoisier, and also by Dr Priestley. M. Lavoisier made the steam of boiling water pass through the barrel of a gun, kept red hot by burning coals. Dr Priestley uses, instead of the gun-barrel, a tube of red-hot brass, upon which the steam of water has no effect, and which he fills with the pieces of iron which are separated in the boring of cannon. By this method he obtains an inflammable air, the specific gravity of which is to that of common air as 1 to 13. In this method, not yet indeed reduced to general practice, a tube about three quarters of an inch in diameter, and about three feet long, is filled with iron turnings; then the neck of a retort, or close boiler, is luted to one of its ends, and the worm of a refrigeratory is adapted to its other extremity. The middle part of the tube is then surrounded with burning coals, so as to keep about one foot in length of it red hot, and a fire is always made under the retort or boiler sufficient to make the water boil with vehemence. In this process a considerable quantity of inflammable air comes out of the worm of the refrigeratory. It is said that iron yields one-half more air by this means than by the action of sulphuric acid.

For filling large balloons, a greater quantity is necessary; and the only materials that can, with any certainty of success, be employed for producing the proper gas, are, sulphuric acid, and iron filings or turnings.

It has indeed been recommended to use zinc instead of iron filings, because white vitriol, the salt produced by the union of the sulphuric acid and zinc, is much more valuable than the green sort produced by the union of the same acid with iron. But though this is undoubtedly the case, it will as certainly be found, upon trial, that the superior price of the zinc will be more than an equivalent for all the advantage that can be derived from the additional price of the white vitriol. For a balloon of 30 feet diameter, Mr Cavallo recommends 3900 pounds of iron turnings, as much sulphuric acid, and 19,500 pounds of water. These proportions, however, appear too great with respect to the acid and metal, and too little with respect to th^o

water. Sulphuric acid will not exert its power upon iron unless it be diluted with five or six times its quantity of water; in which case, a much smaller quantity of both acid and metal will serve. Mr Lunardi, who from the number of his voyages had certainly much practical knowledge in aerostation, filled his balloon at Edinburgh and Glasgow with about 2000 pounds of iron (the borings of cannon procured from Carron), as much sulphuric acid, and 12,000 pounds of water. The iron was placed in his vessels in layers, with straw between them, in order to increase the surface. His apparatus was not materially different from that of Mr Cavallo, fig. 6. where AA are two tubs, about three feet in diameter and nearly two feet deep, inverted in large tubs BB filled with water. In the bottom of each of the inverted tubs a hole is made, and a tube E of tin adapted, which is about seven inches in diameter, and seven or eight long. To these tubes the silken ones of the balloon are to be tied. Round each of the tubs B, five, six, or more strong casks are placed; in the top of each two holes are made, and to one of these holes a tin tube is adapted, and so shaped, that, passing over the edge of the tub B, and through the water, it may terminate with its aperture under the inverted tub A. The other hole of these casks serves for the introduction of materials, and is stopped with a wooden plug. When the balloon is to be filled, put the net over it, and let it be suspended as shown by CDF; and having expelled all the common air from it, let the silken tube be fastened round the tin ones EE; and the materials being put into the casks, the inflammable air, passing into the balloon, will soon distend, and render it capable of supporting itself; after which the rope GH may be slipped off. As the balloon continues to be filled, the net is adjusted properly round it; the cords that surround it are fastened to the hoop MN; then the boat IK being placed between the two sets of casks, is fastened to the hoop MN, and every thing that is required to be sent up, as ballast, instruments, &c. is placed in it. At last when the balloon is little more than three quarters full, the silken tubes are separated from the tin ones of the inverted tubs, and their extremities being tied up, are placed in the boat. Lastly, The aeronauts being seated in the boat, the lateral ropes are slipped off, and the machine is abandoned to the air. (See *Blanchard's Balloon*, Plate III.) This apparatus was at last reduced by Mr Lunardi to its utmost simplicity, by using only two large casks, and suffering the vapour to go into the balloon without passing through water. Thus his balloon was filled in less than half an hour, when, before, it had required two hours at least. The sinking of his casks in the ground was also an additional convenience, as it created no confusion, and rendered the materials much more easily conveyed into them.

With regard to the rarefied air balloons, the method of filling them is as follows. A scaffold ABCD, fig. 7. the breadth of which is at least two-thirds of the diameter of the machine, is elevated about six or eight feet above the ground. From the middle of it descends a well E, rising about two or three feet above it, and reaching to the ground, furnished with a door or two, through which the fire in the well is supplied with fuel. The well should be constructed of brick or of plastered wood,

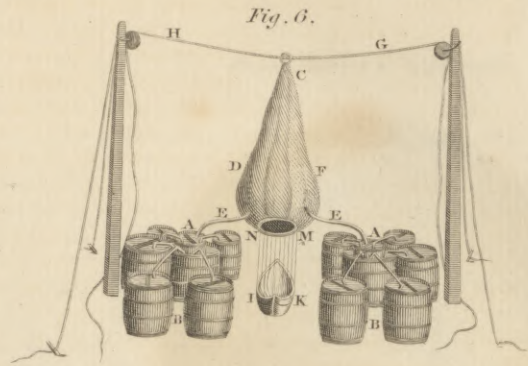
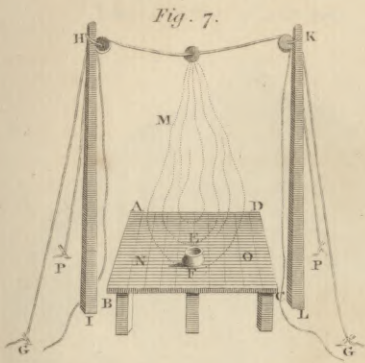


Fig. 1.

VIEW from a BALLOON above the CLOUDS seen by M^r BALDWIN.



Fig. 2.

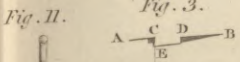
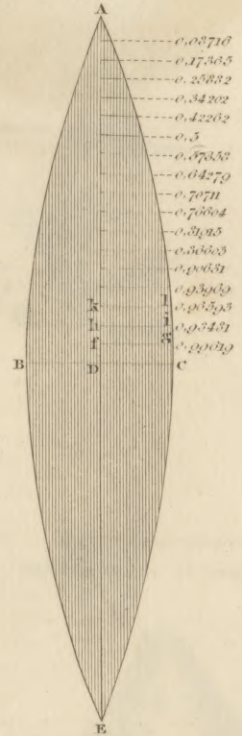


Fig. 11.

Fig. 10.



Fig. 5.



Fig. 8.

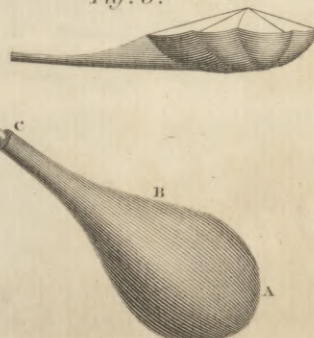


Fig. 9.

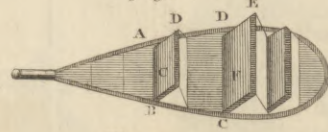


Fig. 4.



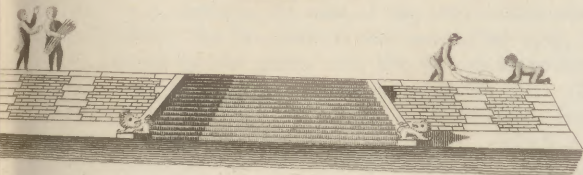
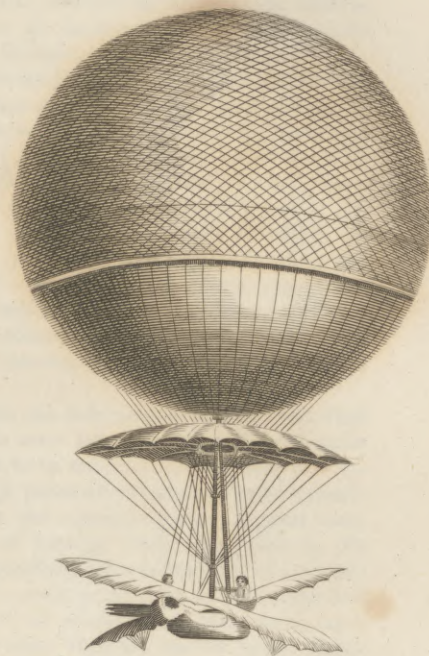
Eng^d by J. Moffat Edin^g

MONTGOLFIER'S BALLOON.
FAUXBOURG ST ANTOINE.

AEROSTATION.

PLATE III.

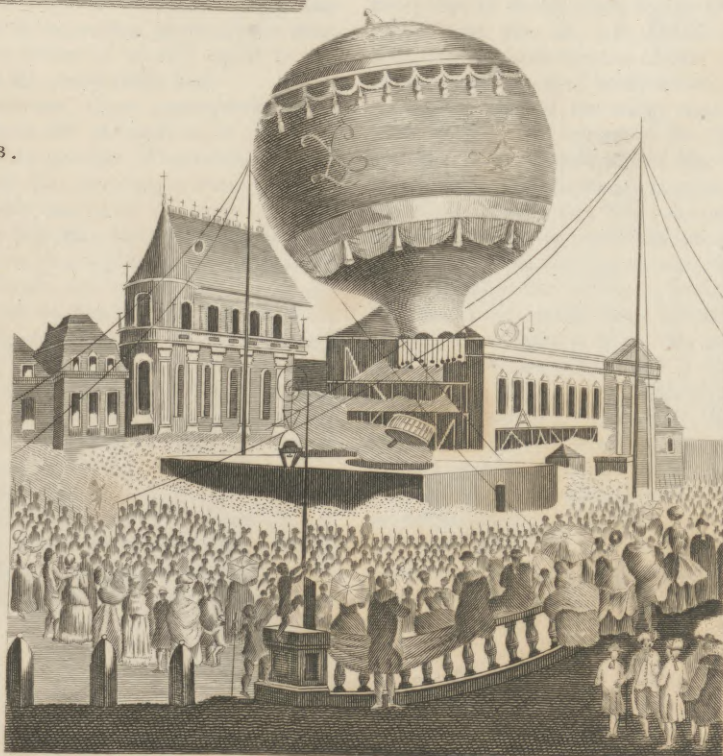
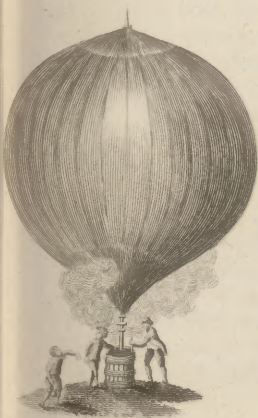
BLANCHARD'S BALLOON.



VERSAILLES
B.

MONTGOLFIER'S B.
FAUXBOURG OF ST GERMAIN.

CHARLES & ROBERTS B.
CAMP DE MARS.



W. Reichardt sculp.

PLATE 1

THE GARDEN

THE GARDEN



THE GARDEN



THE GARDEN

wood, and its diameter should be somewhat less than that of the machine. On each side of the scaffold are erected two masts HI, KL, each of which has a pulley at the top, and rendered firm by means of ropes KG, KP, HP, HG. The machine to be filled is to be placed on the scaffold, with its neck round the aperture of the well. The rope passing over the pulleys of the two masts, serves, by pulling its two ends, to lift the balloon about 15 feet or more above the scaffold; and the rest of the machine is represented by the dotted lines in the figure MNO. The machine is kept steady, and held down, whilst filling, by ropes passing through loops or holes about its equator; and the ropes may easily be disengaged from the machine, by slipping them through the loops when it is able to sustain itself. The proper combustibles to be lighted in the well, are those which burn quick and clear, rather than such as produce much smoke; because it is hot air, not hot smoke, that is required to be introduced into the machine. Small wood and straw have been found to be very fit for this purpose. Mr Cavallo observes, as the result of many experiments with small machines, that spirit of wine is upon the whole the best combustible; but its price may prevent its being used for large machines. As the current of hot air ascends, the machine will soon dilate, and lift itself above the scaffold and gallery which was covered by it. The passengers, fuel, instruments, &c. are then placed in the gallery. When the machine makes efforts to ascend, its aperture must be brought, by means of the ropes annexed to it, towards the side of the well a little above the scaffold; the fire place is then suspended in it, the fire lighted in the grate, and the lateral ropes being slipped off, the machine is abandoned to the air. (See *Montgolfier's balloon*, Plate III.) It has been determined by accurate experiments, that only one-third of the common air can be expelled from these large machines: and therefore the ascending power of the rarefied air in them can be estimated as only equal to half an ounce avoirdupoise for every cubic foot.

The conduct of balloons, when constructed, filled, and actually ascending in the atmosphere, is an object of great importance in the practice of aerostation. The method generally used for elevating or lowering the balloons with rarefied air, has been the increase or diminution of the fire: and this is entirely at the command of the aeronaut, as long as he has any fuel in the gallery. The inflammable air balloons have been generally raised or lowered by diminishing the weight in the boat, or by letting out some of the gas through the valve; but the alternate escape of the air in descending, and discharge of the ballast for ascending, will by degrees render the machine incapable of floating; for in the air it is impossible to supply the loss of ballast, and very difficult to supply that of inflammable air. These balloons will also rise or fall by means of the rarefaction or condensation of the enclosed air, occasioned by heat and cold. It has been proposed to aid a balloon in its alternate motion of ascent and descent, by annexing to it a vessel of common air, which

might be condensed for lowering the machine, and rarefied again, by expelling part of it, for raising the machine: But a vessel adapted to this purpose must be very strong; and, after all, the assistance afforded by it would not be very considerable. M. Meunier, in order to attain this end, proposes to enclose one balloon filled with common air in another filled with inflammable air: as the balloon ascends, the inflammable air is dilated, and of course compresses the internal balloon containing the common air: and by diminishing its quantity, lessens its weight. If it should be necessary to supply this loss, he says it may be easily done by a pair of bellows fixed in the gallery. Others have proposed to annex a small machine with rarefied air to an inflammable air balloon by ropes, at such a distance that the fire of the former might not affect the inflammable air of the latter: the whole apparatus, thus combined, of balloons formed on the two principles of heated and inflammable air, might be raised or lowered by merely increasing or diminishing the fire in the lower balloon.

Wings or oars are the only means of this sort that have been used with some success: and, as Mr Cavallo observes, they seem to be capable of considerable improvement; although great effects are not to be expected from them, when the machine goes at a great rate. The best methods of moving those wings are by the human strength applied similarly to the oars of a waterman. They may be made in general of silk stretched between wires, tubes, or sticks; and when used, must be turned edgewise when they are moved in the direction in which the machine is intended to be impelled, but flat in the opposite direction. Fig. 8. is the representation of one of Mr Blanchard's wings. Fig. 9. is one of those used by Mr Lunardi, which consists of many silk shutters or valves, ABCD, DECF, &c. every one of which opens on one side only, viz. ADBC opens upon the line AB, DECF opens upon the line DC, &c. In consequence of this construction, this sort of oars does not need being turned edgewise. Fig. 10. represents one of the wings used by the brothers Roberts in the aerial voyage of the 19th September 1784; and fig. 11. represents one of the wings constructed by Count Zambeccari, which consists of a piece of silk stretched between two thin tubes set at an angle; but these wings are so contrived as to turn edgewise by themselves when they go on one direction. Other contrivances have been made to direct aerostatic machines, but they have mostly been invented to effect a power upon them as upon a ship. It appears, however, that they can have no effect when a machine is only moved by the wind alone, because the circumambient air is at rest in respect to the machine. The case is quite different with a vessel at sea, because the water on which it floats stands still whilst the vessel goes on; but it must be time and experience that can realize the expectations suggested by these contrivances.

A view of the principles of this science, and of the more recent aerial voyages, is given under the article AERONAUTICS in the SUPPLEMENT.

Aerschot
||
Æschines.

AERSCHOT, a town of the Austrian Netherlands in the duchy of Brabant, and capital of the duchy of Aerschot. It is seated on the river Demur, ten miles east of Malines or Mechlin, and eight north of Louvain. E. Long. 5. 44. N. Lat. 51.

ÆRUGINOUS, an epithet given to such things as resemble or partake of the nature of the rust of copper.

ÆRUGO, in *Natural History*, properly signifies the rust of copper, whether natural or artificial. The former is found about copper mines, and the latter, called *verdigris*, made by corroding copper plates with acids.

ÆRUSCATORES, in *Antiquity*, a kind of strolling beggars, not unlike gypsies, who drew money from the credulous by fortune-telling, &c. It was also a denomination given to griping exactors, or collectors of the revenue. The Galli, or priests of Cybele, were called *æruscatores magnæ matris*; and *ἰερείαι*, on account of their begging or collecting alms in the streets; to which end they had little bells to draw people's attention, similar to some orders of mendicants abroad.

AERY, or **AIRY**, among sportsmen. See **AIRY**.

ÆS UXORIUM, in *Antiquity*, a sum paid by bachelors, as a penalty for living single to old age. This tax for not marrying seems to have been first imposed in the year of Rome 350, under the censorship of M. Furius Camillus and M. Posthumus. At the census, or review of the people, each person was asked, *Et tu ex anima sententia uxorem habes liberum querendum causa?* He who had no wife was hereupon fined after a certain rate, called *æs uxorium*.

Æs per et libram was a formula in the Roman law, whereby purchases and sales were ratified. Originally the phrase seems to have been only used in speaking of things sold by weight, or by the scales: but it afterwards was used on other occasions. Hence even in adoptions, as there was a kind of imaginary purchase, the formula thereof expressed, that the person adopted was bought *per æs et libram*.

Æs Flavum, yellow copper, among the Romans, an appellation given to the coarser kinds of brass.

The ancients had different kinds of brass, as *æs candidum*, *æs Corinthium*, denoting probably different metallic alloys or mixtures.

Æs Caldarium, a term used by the German mineralists, for a substance which sometimes occurs to those who work upon cobalt, and is used for making the fine blue colour called *smalt*.

Æs Ustum, a chemical preparation, made of thin leaves of copper, sulphur, and nitre, placed *stratum super stratum* in a crucible, and set in a charcoal fire till all the sulphur is consumed; after which, the copper is taken out of the crucible, and reduced to powder. Some quench the leaves of copper in vinegar, and repeat the calcination.—Its principal use is in colouring glass, to which it gives a beautiful tincture. The surgeons use it as a detersive, and some have given it internally; but it is certainly a very dangerous medicine, and should be avoided.

ÆSCHINES, an Athenian, a Socratic philosopher, the son of Charinus a sausage-maker. He was continually with Socrates; which occasioned this philosopher to say, that the sausage-maker's son was the only

person who knew how to pay a due regard to him. Æschines
It is said that poverty obliged him to go to Sicily to Dionysius the tyrant; and that he met with great contempt from Plato, but was extremely well received by Aristippus; to whom he showed some of his dialogues, and received from him a handsome reward. He would not venture to profess philosophy at Athens, Plato and Aristippus being in such high esteem; but he opened a school in which he taught philosophy to maintain himself. He afterwards wrote orations for the forum. Phrynichus, in Photius, ranks him amongst the best orators, and mentions his orations as the standard of the pure Attic style. Hermogenes has also spoken very highly of him. He wrote besides several Dialogues, of which there are only three extant: 1. Concerning virtue, whether it can be taught. 2. Eryxias, or Erasistratus; concerning riches, whether they are good. 3. Axiochus; concerning death, whether it is to be feared. M. Le Clerc has given a Latin translation of them, with notes and several dissertations, entitled *Sylvæ Philologicæ*.

ÆSCHINES, a celebrated Grecian orator, was born at Athens 327 years before the Christian era. According to his own account, he was of distinguished birth; according to that of Demosthenes, he was the son of a courtesan, and a humble performer in a company of comedians. But whatever was the true history of his birth and early life, his talents, which were considerable, procured him great applause, and enabled him to be a formidable rival to Demosthenes himself. The two orators, inspired probably with mutual jealousy and animosity, became at last the strenuous leaders of opposing parties. Æschines was accused by Demosthenes of having received money as a bribe, when he was employed on an embassy to Philip of Macedon. He indirectly retaliated the charge by bringing an accusation against Ctesiphon the friend of Demosthenes for having moved a decree, contrary to the laws, to confer on Demosthenes a golden crown, as a mark of public approbation. A numerous assembly of judges and citizens met to hear and decide the question: each orator employed all his powers of eloquence; but Demosthenes, with superior talents, and with justice on his side, was victorious; and Æschines was sent into exile. The resentment of Demosthenes was now softened into generous kindness; for when Æschines was going into banishment, he requested him to accept of a sum of money; which made him exclaim, "How do I regret leaving a country where I have found an enemy so generous, that I must despair of ever meeting with a friend who shall be like him!"

Æschines opened a school of eloquence at Rhodes, which was the place of his exile, and he commenced his lectures by reading to his audience the two orations which had been the cause of his banishment. His own oration received great praise; but that of Demosthenes was heard with boundless applause. In so trying a moment, when vanity must be supposed to have been deeply wounded, with a noble generosity of sentiment, he said, "What would you have thought if you had heard him thunder out the words himself."—Æschines afterwards removed to Samos, where he died, in the 75th year of his age. Three of his orations only are extant. His eloquence is not without energy,

chines, energy, but it is diffuse and ornamented, and more
 chylus, calculated to please than to move the passions. (*Gen.*
Biog.)

ÆSCHYLUS, the tragic poet, was born at Athens. The time of his birth is not exactly ascertained; some suppose that it was in the 65th, others in the 70th Olympiad; but according to Stanley, who follows the Arundelian marbles, he was born in the 63d Olympiad. He was the son of Euphorion, and brother to Cynegirus and Aminias, who distinguished themselves in the battle of Marathon, and the sea-fight of Salamis, at which engagements Æschylus was likewise present. In this last action, according to Diodorus Siculus, Aminias, the younger of the three brothers, commanded a squadron of ships, and fought with so much conduct and bravery, that he sunk the admiral of the Persian fleet, and signalized himself above all the Athenians. To this brother our poet was, upon a particular occasion, obliged for saving his life: Ælian relates, that Æschylus being charged by the Athenians with certain blasphemous expressions in some of his pieces, was accused of impiety, and condemned to be stoned to death: They were just going to put the sentence in execution, when Aminias, with a happy presence of mind, throwing aside his cloak, showed his arm without a hand, which he had lost at the battle of Salamis in defence of his country. This sight made such an impression on the judges, that, touched with the remembrance of his valour, and with the friendship he showed for his brother, they pardoned Æschylus. Our poet, however, resented the indignity of this prosecution, and resolved to leave a place where his life had been in danger. He became more determined in this resolution when he found his pieces less pleasing to the Athenians than those of Sophocles, though a much younger writer. Some affirm, that Æschylus never sat down to compose but when he had drank liberally. He wrote a great number of tragedies, of which there are but seven remaining: and notwithstanding the sharp censures of some critics, he must be allowed to have been the father of the tragic art. In the time of Thespis, there was no public theatre to act upon; the strollers driving about from place to place in a cart. Æschylus furnished his actors with masks, and dressed them suitably to their characters. He likewise introduced the huskin, to make them appear more like heroes.—The ancients gave Æschylus also the praise of having been the first who removed murders and shocking sights from the eyes of the spectators. He is said likewise to have lessened the number of the choros. M. Le Fevre has observed, that Æschylus never represented women in love in his tragedies; which, he says, was not suited to his genius; but, in representing a woman transported with fury, he was incomparable. Longinus says, that Æschylus has a noble boldness of expression; and that his imagination is lofty and heroic. It must be owned, however, that he affected pompous words, and that his sense is too often obscured by figures: this gave Salmasius occasion to say, that he was more difficult to be understood than the Scripture itself. But notwithstanding these imperfections, this poet was held in great veneration by the Athenians, who made a public decree that his tragedies should be played after his death. He was killed in the 69th year of his age, by

an eagle letting fall a tortoise upon his head as he was walking in the fields. He had the honour of a pompous funeral from the Sicilians, who buried him near the river Gela; and the tragedians of the country performed plays and theatrical exercises at his tomb.—The best edition of his plays is that of London, 1663, folio, with a Latin translation and a learned commentary by Thomas Stanley.

ÆSCHYNOMENÉ, BASTARD SENSITIVE PLANT, in *Botany*. See *BOTANY Index*.

ÆSCULAPIUS, in the heathen mythology, the god of physic, was the son of Apollo and the nymph Coronis. He was educated by the centaur Chiron, who taught him physic; by which means Æsculapius cured the most desperate diseases. But Jupiter, enraged at his restoring to life Hippolitus, who had been torn in pieces by his own horses, killed him with a thunderbolt. According to Cicero, there were three deities of this name: the first, the son of Apollo, worshipped in Arcadia, who invented the probe, and bandages for wounds; the second, the brother of Mercury, killed by lightning; and the third, the son of Arisippus and Arsinoe, who first taught the art of tooth-drawing and purging. At Epidaurus, Æsculapius's statue was of gold and ivory, with a long beard, his head surrounded with rays, holding in one hand a knotty stick, and the other entwined with a serpent; he was seated on a throne of the same materials as his statue, and had a dog lying at his feet. The Romans crowned him with laurel, to represent his descent from Apollo; and the Phliasians represented him as beardless. The cock, the raven, and the goat, were sacred to this deity. His chief temples were at Pergamus, Smyrna, Trica a city in Ionia, and the isle of Coos; in all which votive tablets were hung up, showing the diseases cured by his assistance. But his most famous shrine was at Epidaurus; where, every five years, games were instituted to him, nine days after the Isthmian games at Corinth.

ÆSCULUS, the HORSE-CHESNUT, in *Botany*. See *BOTANY Index*.

ÆSOP, the Phrygian, lived in the time of Solon, about the 50th Olympiad, under the reign of Croesus the last king of Lydia. As to genius and abilities, he was greatly indebted to nature; but in other respects not so fortunate, being born a slave and extremely deformed. St Jerome, speaking of him, says he was unfortunate in his birth, condition in life, and death; hinting thereby at his deformity, servile state, and tragical end. His great genius, however, enabled him to support his misfortunes; and in order to alleviate the hardships of servitude, he composed those entertaining and instructive fables which have acquired him so much reputation. He is generally supposed to have been the inventor of that kind of writing; but this is contested by several, particularly Quintilian, who seems to think that Hesiod was the first author of fables. Æsop, however, certainly improved this art to a very great degree; and hence it is that he has been accounted the author of this sort of productions:

*Æsopus auctor quam materiam reperit,
 Hanc ego polivi versibus senariis.*

PHÆD.

Mine is the task, in easy verse,
 The tales of Æsop to rehearse.

The

Æschylus
 ||
 Æsop.

Æsop.

The first master whom Æsop served, was one Carasius Demarchus, an inhabitant of Athens; and there, in all probability, he acquired his purity in the Greek tongue. After him he had several masters; and at length came under a philosopher named Idmon or Iadmon, who enfranchised him. After he had recovered his liberty, he soon acquired a great reputation amongst the Greeks; so that, according to Meziriae, the report of his wisdom having reached Cræsus, he sent to enquire after him, and engaged him in his service. He travelled through Greece, according to the same author; whether for his own pleasure, or upon the affairs of Cræsus, is uncertain; and passing by Athens soon after Pisistratus had usurped the sovereign power, and finding that the Athenians bore the yoke very impatiently, he told them the fable of the frogs who petitioned Jupiter for a king. The images made use of by Æsop are certainly very happy inventions to instruct mankind; they possess all that is necessary to perfect a precept, having a mixture of the useful with the agreeable. "Æsop the fabulist (says Aulus Gellius) was deservedly esteemed wise, since he did not, after the manner of the philosophers, rigidly and imperiously dictate such things as were proper to be advised and persuaded; but framing entertaining and agreeable apologues, he thereby charms and captivates the human mind."—Æsop was put to death at Delphi. Plutarch tells us, that he came there with a great quantity of gold and silver, being ordered by Cræsus to offer a sacrifice to Apollo, and to give a considerable sum to each inhabitant: but a quarrel arising betwixt him and the Delphians, he sent back the money to Cræsus; for he thought those for whom the prince designed it, had rendered themselves unworthy of it. The inhabitants of Delphi brought an accusation of sacrilege against him; and pretending they had convicted him, threw him headlong from a rock. For this cruelty and injustice, we are told they were visited with famine and pestilence; and consulting the oracle, they received for answer, that the god designed this as a punishment for their treatment of Æsop: they endeavoured to make an atonement, by raising a pyramid to his honour.

Æsop, *Clodius*, a celebrated actor, who flourished about the 670th year of Rome. He and Roscius were cotemporaries, and the best performers who ever appeared upon the Roman stage; the former excelling in tragedy, the latter in comedy. Cicero put himself under their direction to perfect his action. Æsop lived in a most expensive manner, and at one entertainment is said to have had a dish which cost above eight hundred pounds; this dish, we are told, was filled with singing and speaking birds, some of which cost near 50*l*. The delight which Æsop took in this sort of birds proceeded, as Mr Bayle observes, from the expence. He did not make a dish of them because they could speak, according to the refinement of Pliny upon this circumstance, this motive being only by accident; but because of their extraordinary price. If there had been any birds that could not speak, and yet more scarce and dear than these, he would have procured such for his table. Æsop's son was no less luxurious than his father, for he dissolved pearls for his guests to swallow. Some speak of this as a common practice of his; but others mention his falling into this excess only on a particular day, when he was treating his friends. Ho-

race * speaks only of one pearl of great value, which he dissolved in vinegar, and drank. Æsop, notwithstanding his expences, is said to have died worth above 160,000*l*. When he was upon the stage, he entered into his part to such a degree, as sometimes to be seized with a perfect ecstasy: Plutarch mentions it as reported of him, that whilst he was representing Atreus deliberating how he should revenge himself on Thyestes, he was so transported beyond himself in the heat of action, that with his truncheon he smote one of the servants crossing the stage, and laid him dead on the spot.

ÆSTIMATIO CAPITIS, a term met with in old law books for a fine anciently ordained to be paid for offences committed against persons of quality, according to their several degrees.

ÆSTIVAL, in a general sense, denotes something connected with, or belonging to, summer. Hence, æstival sign, æstival solstice, &c.

ÆSTUARIA, in *Geography*, denotes an arm of the sea, which runs a good way within land. Such is the Bristol channel, and many of the friths of Scotland.

ÆSTUARIES, in ancient baths, were secret passages from the hypocaustum into the chambers.

ÆSTUARY, among physicians, a vapour bath, or any other instrument for conveying heat to the body.

ÆSYMNIUM, in antiquity, a monument erected to the memory of the heroes by Æsymnus the Megarean. He, consulting the oracle in what manner the Megareans might be most happily governed, was answered, *If they held consultation with the more numerous*: whom he taking for the dead, built the said monument, and a senate-house that took within its compass the monument; imagining, that thus the dead would assist at their consultations. (Pausanias).

AETH, or ATH, a strong little town in the Austrian Netherlands and province of Hainault, situated on the river Dender, about twenty miles south-west of Brussels.

ÆTHALIA, or ILUA, in *Ancient Geography*, now *Elba*; an island on the coast of Etruria, in compass an hundred miles, abounding in iron. It was so called from αἰθάλῃ, smoke, which issued from the shops of Vulcan.

ÆTHELSTAN, see ATHELSTAN.

ÆTHER, is usually understood of a thin, subtile matter, or medium, much finer and rarer than air; which commencing from the limits of our atmosphere, possesses the whole heavenly space.—The word is Greek, αἰθήρ, supposed to be formed from the verb αἰθεῖν, "to burn, to flame;" some of the ancients, particularly Anaxagoras, supposing it to be of the nature of fire.

The philosophers cannot conceive that the largest part of the creation should be perfectly void; and therefore they fill it with a species of matter under the denomination of *æther*. But they vary extremely as to the nature and character of this *æther*. Some conceive it as a body *sui generis*, appointed only to fill up the vacuities between the heavenly bodies; and therefore confined to the regions above our atmosphere. Others suppose it of so subtile and penetrating a nature, as to pervade the air and other bodies, and possess the pores and intervals thereof. Others deny the existence of any such specific matter; and think the air itself, by that immense tenuity and expansion it is found capable of,

Æsop.
Æther.
* Sat. II.
lib. II. 239

ther. of, may diffuse itself through the interstellar spaces, and be the only matter found therein.

In effect, æther, being no object of our sense, but the mere work of imagination, brought only upon the stage for the sake of hypothesis, or to solve some phenomenon, real or imaginary; authors take the liberty to modify it how they please. Some suppose it of an elementary nature, like other bodies; and only distinguished by its tenuity, and the other affections consequent thereon: which is the philosophical æther. Others will have it of another species, and not elementary; but rather a sort of fifth element, of a purer, more refined, and spirituous nature, than the substances about our earth; and void of the common affections thereof, as gravity, &c. The heavenly spaces being the supposed region or residence of a more exalted class of beings, the medium must be more exalted in proportion. Such is the ancient and popular idea of æther, or æthereal matter.

The term *æther* being thus embarrassed with a variety of ideas, and arbitrarily applied to so many different things, the later and severer philosophers choose to set it aside, and in lieu thereof substitute other more determinate ones. Thus, the Cartesians use the term *materia subtilis*; which is their æther: and Sir Isaac Newton, sometimes a *subtile spirit*, as in the close of his *Principia*; and sometimes a *subtile* or *æthereal medium*, as in his *Optics*.

Heat, Sir Isaac Newton observes, is communicated through a vacuum almost as readily as through air: but such communication cannot be without some interjacent body, to act as a medium. And such body may be subtile enough to penetrate the pores of glass, and may permeate those of all other bodies, and consequently be diffused through all the parts of space.

The existence of such an æthereal medium being settled, that author proceeds to its properties; inferring it to be not only rarer and more fluid than air, but exceedingly more elastic and active; in virtue of which properties he shows, that a great part of the phenomena of nature may be produced by it. To the weight, e. g. of this medium, he attributes gravitation, or the weight of all other bodies; and to its elasticity the elastic force of the air and of nervous fibres, and the emission, refraction, reflection, and other phenomena of light; as also, sensation, muscular motion, &c. In fine, this same matter seems the *primum mobile*, the first source or spring of physical action in the modern system.

The Cartesian æther is supposed not only to pervade, but adequately to fill, all the vacuities of bodies: and thus to make an absolute plenum in the universe.

But Sir Isaac Newton overturns this opinion, from divers considerations; by showing, that the celestial spaces are void of all sensible resistance: and, hence it follows, that the matter contained therein must be immensely rare, in regard the resistance of bodies is chiefly as their density: so that if the heavens were thus adequately filled with a medium or matter, how subtile soever, they would resist the motion of the planets and comets much more than quicksilver or gold. But it has been supposed that what Newton has said of æther is to be considered only as a conjecture, and especially as no new proofs of its existence have been adduced since his time.

The late discoveries in electricity have thrown great
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light upon this subject, and rendered it extremely probable that the æther so often talked of is no other than the electric fluid, or solar light, which diffuses itself throughout the whole system of nature.

ÆTHER, in *Chemistry*, a light, volatile, and very inflammable liquid, produced by distillation of acids with rectified spirit of wine. See *CHEMISTRY Index*.

ÆTHEREAL, ÆTHEREUS, something that belongs to, or partakes of, the nature of ÆTHER. Thus we say, *the æthereal space, æthereal regions, &c.*

Some of the ancients divided the universe, with respect to the matter contained therein, into elementary and æthereal.

Under the æthereal world was included all that space above the uppermost element, viz. fire. This they supposed to be perfectly homogeneous, incorruptible, unchangeable, &c. The Chaldees placed an æthereal world between the empyreum and the region of the fixed stars. Besides which, they sometimes also speak of a second æthereal world, meaning by it the starry orb: and a third æthereal world, by which is meant the planetary region.

ÆTHIOPIA. See *ETHIOPIA* and *ABYSSINIA*.

ÆTHIOPS, *Mineral, Martial, and Antimonial*. See *CHEMISTRY Index*.

ÆTHUSA, FOOL'S PARSLEY, in *Botany*. See *BOTANY Index*.

AETIANS, in church history, a branch of Arians, who maintained that the Son and Holy Ghost are in all things dissimilar to the Father. See *AETIUS*.

ÆTIOLOGY, is that part of pathology which is employed in exploring the causes of diseases.

AETION, a celebrated painter, who has left us an excellent picture of Roxana and Alexander, which he exhibited at the Olympic games; it represents a magnificent chamber, where Roxana is sitting on a bed of a most splendid appearance, which is rendered still more brilliant by her beauty. She looks downwards, in a kind of confusion, being struck with the presence of Alexander standing before her. A number of little Cupids flutter about, some holding up the curtain, as if to show Roxana to the prince, whilst others are busied in undressing the lady; some pull Alexander by the cloak, who appears like a young bashful bridegroom, and present him to his mistress: he lays his crown at her feet, being accompanied by Ephestion, who holds a torch in his hand, and leans upon a youth, who represents Hymen. Several other little Cupids are represented playing with his arms; some carry his lance, stooping under so heavy a weight; others bear along his buckler, upon which one of them is seated, whom the rest carry in triumph; another lies in ambush in his armour, waiting to frighten the rest as they pass by. This picture gained Aetion so much reputation, that the president of the games gave him his daughter in marriage.

ÆTITES, or EAGLE-STONE, in *Natural History*, a flinty or crustated stone, hollow within, and containing a *nucleus*, which, on shaking, rattles within. It was formerly in repute for several extraordinary magical as well as medical powers; such as preventing abortion, discovering thieves, and other ridiculous properties. The word is formed from *ætos*, "eagle," the popular tradition being, that it is found in the eagle's nest, whither it is supposed to be carried while the female

Ætites
||
Ætna.

male sits, to prevent her eggs from being rotten. It is found in several parts; near Trevoux in France, one can scarcely dig a new feet, without finding considerable strata or beds of the coarser or ferruginous kind. They are originally soft, and of the colour of yellow ochre. But the finest and most valued of all the eagle-stones, are accidental states of one or other of our common pebbles.

ÆTIUS, one of the most zealous defenders of Arianism, was born in Syria, and flourished about the year 336. After being servant to a grammarian, of whom he learned grammar and logic, he was ordained deacon, and at length bishop, by Eudoxus patriarch of Constantinople. Ætius was banished into Phrygia on account of his religious opinions; but was recalled from exile on the accession of Julian, and was much esteemed by that emperor. He died, it is supposed, at Constantinople, about the year 366. St Epiphanius has preserved 47 of his propositions against the Trinity. His followers were called **ÆTIANS**.

ÆTIUS, a famous physician, born at Amida in Mesopotamia, and the author of a work entitled *Tetrabiblos*, which is a collection from the writings of those physicians who went before him. He lived, according to Dr Freind, at the end of the fifth or the beginning of the sixth century.

ÆTIUS, governor of Gallia Narbonensis in the reign of Valentinian III. forced the Franks who were passing into Gaul to repass the Rhine. He defeated the Goths; and routed Attila king of the Huns, who invaded Gaul with an army of 700,000 men. But the emperor, jealous of the merit of this great man, killed him in 454, with his own hand, under the pretence that he had permitted the invasion of the Huns, after Attila's defeat.

ÆTNA, (in the Itineraries *Æthana*, supposed from *aitō*, "to burn;" according to Bochart, from *athuna*, a furnace, or *ætuna*, darkness), now *Monte Gibello*: a volcano or burning mountain of Sicily, situated in N. Lat. 38°. E. Long. 15°.

This mountain, famous from the remotest antiquity, both for its bulk and terrible eruptions, stands in the eastern part of the island, in a very extensive plain, called *Val di Demoni*, from the notion of its being inhabited by devils, who torment the spirits of the damned in the bowels of this volcano.

Inconsistent accounts concerning the magnitude of Ætna.

Concerning the dimensions of Mount Ætna, we can scarcely extract any thing consistent, even from the accounts of the latest and most ingenious travellers. Pindar, who lived about 435 years before Christ, calls it the *Pillar of Heaven*, on account of its great height. All modern writers likewise agree, that this mountain is very high, and very large; but differ much both as to its height and magnitude: some making it no less than twelve miles high, others eight, others six, some four; while Mr Brydone, and Sir William Hamilton, who lately ascended to its highest summit, reduce its height to little more than two miles; nay by some it is reduced to 10,036 feet, somewhat less than two miles. No less remarkable are the differences concerning its circumference: some making it only 60 miles round, others 100; and Signior Recupero, from whom Mr Brydone had his information in this respect, affirms it to be no less than 183 miles in circuit.

Ætna.

We are sorry to detract from the merit of Mr Brydone, or to involve in obscurity what he has been at so much pains to elucidate; but every person who compares the account of Mount Ætna's circumference, given by Signior Recupero, and to which Mr Brydone seems to have assented, with its apparent circumference on the map prefixed to that gentleman's tour through Sicily and Malta, must at once be struck with the prodigious disparity. Indeed, it is plain, that in the map, the geographer has not left room for any such mountain: nor can we help thinking, that, by comparing the distances of some of the Sicilian towns from one another, Signior Recupero's dimensions will be found enormously exaggerated.—Certain it is, that where the geographer has placed Catania, which stands at the foot of Mount Ætna, on one side, there is no more than 28 miles from the most distant point of the river Alcantara, which forms the boundary on the opposite side; so that a circle, whose radius is 14 or 15 miles, must encompass as much space as we can possibly think is occupied by the basis of Mount Ætna. Thus we shall reduce the circumference of this famous mountain to between 80 and 90 miles; and even when we do so, it is perhaps too great.

But if we are embarrassed with the circumference of Ætna, we are much more so with the accounts relating to its height; and one circumstance, particularly, creates almost unsurmountable difficulties. It is agreed upon by all travellers, and among the rest by Sir William Hamilton, that, from Catania, where the ascent first begins, to the summit, is not less than 30 miles. The descent on the other side we have no account of; but whatever supposition we make, the height of the mountain must be prodigious. If we suppose it likewise to be 30 miles, and that Mount Ætna can be represented by an equilateral triangle, each of whose sides is 30 miles, we will have an amazing elevation indeed, no less than 26 miles perpendicular. Such a height being beyond all credibility, we must contract the sides of our triangle, in proportion to its basis. We shall begin with allowing ten miles for the difference between a straight line from Catania to the summit, and the length of the road, occasioned by the inequalities of the mountain; and supposing the descent on the other side to be somewhat shorter, we may call it 15 miles. Mount Ætna will now be represented by a scalene triangle, whose base is 30 miles, its longest side 20, and its shortest 15; from which proportions we will still find its height to be betwixt eight and nine miles.—This is still incredible: and when all the various relations concerning the height of Ætna are compared, we hope it will not be thought presumptuous in us to give it as our opinion, that the true dimensions of this mountain are as yet unknown. The following measures are given by different authors.

Dimensions uncertain

Height above the surface of the sea, 10,036 feet.

One hundred and eighty miles circumference at the base.—Faujas de St Fond, in his *Volcans du Vivarais*.

Height 12,000 feet.—Brydone. Tour to Sicily.

Height 2500 toises.—La Platrière, said as from Recupero.

Height 1950 toises.—Diameter 30 miles.—Mentelle Geogr. comp.

Others make its height only 2000 toises, and its superficies 300 square miles.

Concerning

Concerning the products and general appearance of this volcano, authors are much better agreed.—The journey from Catania to its summit has been lately described by several travellers, M. D'Orville, Mr Brydone, Sir William Hamilton, M. Houel, and the abbé Spallanzani. They all agree, that this single mountain affords an epitome of the different climates throughout the whole world: towards the foot, it is extremely hot; farther up, more temperate; and grows gradually more and more cold the higher we ascend. At the very top, it is perpetually covered with snow: from thence the whole island is supplied with that article, so necessary in a hot climate, and without which the natives say Sicily could not be inhabited. So great is the demand for this commodity, that the bishop's revenues, which are considerable, arise from the sale of Mount Ætna's snow; and he is said to draw roool. a-year from one small portion lying on the north side of the mountain. Great quantities of snow and ice are likewise exported to Malta and Italy, making a considerable branch of commerce. On the north side of this snowy region, Mr Brydone was assured that there are several small lakes which never thaw; and that the snow, mixed with the ashes and salt of the mountain are accumulated to a vast depth. The quantity of salts contained in this mountain, he, with great probability, conjectures to be one reason of the preservation of its snows; for salt increases the coldness of snow to a surprising degree.

In the middle of the snowy region stands the great crater, or mouth of Ætna; from which, though contrary to the usual method of travellers, we shall begin our particular account of this mountain. Sir William Hamilton describes the crater as a little mountain, about a quarter of a mile perpendicular, and very steep, situated in the middle of a gently inclining plain, of about nine miles in circumference. It is entirely formed of stones and ashes; and, as he was informed by several people of Catania, had been thrown up about 25 or 30 years before the time (1769) he visited Mount Ætna. Before this mountain was thrown up, there was only a prodigious large chasm, or gulf, in the middle of the above-mentioned plain; and it has been remarked, that about once in 100 years the top of Ætna falls in; which undoubtedly must be the case at certain periods, or the mountain behaved continually to increase in height. As this little mountain, though emitting smoke from every pore, appeared solid and firm, Sir William Hamilton and his companions went up to the very top. In the middle is a hollow, about two miles and a half in circumference, according to Sir William Hamilton; three miles and a half, according to Mr Brydone; and three or four, according to M. D'Orville. The inside is crusted over with salts and sulphur of different colours. It goes shelving down from the top, like an inverted cone; the depth, in Sir W. Hamilton's opinion, nearly corresponding to the height of the little mountain. From many places of this space issue volumes of sulphurous smoke, which being much heavier than the circumambient air, instead of ascending in it, roll down the side of the mountain, till, coming to a more dense atmosphere, it shoots off horizontally, and forms a large track in the air, according to the direction of the wind; which, happily for our travellers, carried it exactly to the side opposite to which they

were placed. In the middle of this funnel is the tremendous and unfathomable gulf, so much celebrated, in all ages, both as the terror of this life, and the place of punishment in the next. From this gulf continually issue terrible and confused noises, which in eruptions are increased to such a degree as to be heard at a prodigious distance. Its diameter is probably very different at different times: for Sir W. Hamilton observed, by the wind clearing away the smoke from time to time, that the inverted hollow cone was contracted almost to a point; while M. D'Orville and Mr Brydone found the opening very large. Both Mr Brydone and Sir W. Hamilton found the crater too hot to descend into it; but M. D'Orville was bolder: and accordingly he and his fellow traveller, fastened to ropes which two or three men held at a distance for fear of accidents, descended as near as possible to the brink of the gulf; but the small flames and smoke which issued from it on every side, and a greenish sulphur, and punice stones, quite black, which covered the margin, would not permit them to come so near as to have a full view. They only saw distinctly, in the middle, a mass of matter which rose in the shape of a cone, to the height of above 60 feet, and which towards the base, as far as their sight could reach, might be 600 or 800 feet. While they were observing this substance, some motion was perceived on the north side, opposite to that whereon they stood; and immediately the mountain began to send forth smoke and ashes. This eruption was preceded by a sensible increase of its internal roarings; which, however, did not continue; but after a moment's dilatation, as if to give it vent, the volcano resumed its former tranquillity; but as it was by no means proper to make a long stay in such a place, our travellers immediately returned to their attendants.

On the summit of Mount Ætna, Sir W. Hamilton observes, that he was sensible of a difficulty in respiration from the too great subtilty of the air, independent of what arose from the sulphureous smoke of the mountain. Mr Brydone takes no notice of this: which probably rose from the air being in a more rarefied state at the time of Sir W. Hamilton's observation than of Mr Brydone's; the barometer, as observed by the former, standing at 18 inches and 10 lines, by the latter at 19 inches $6\frac{1}{2}$ lines.

In these high regions there is generally a very violent wind, which, as all our travellers found it constantly blowing from the south, is perhaps most frequently directed from that point. Here Mr Brydone's thermometer fell to 27° .

The top of Ætna being above the common region of vapour, the heavens appear with exceeding great splendour.—Mr Brydone and his company observed, as they ascended in the night, that the number of stars seemed to be indefinitely increased, and the light of each of them appeared brighter than usual; the whiteness of the milky-way was like a pure flame which shot across the heavens; and, with the naked eye, they could observe clusters of stars that were invisible from below. Had Jupiter been visible, he is of opinion that some of his satellites might have been discovered with the naked eye, or at least with a very small pocket glass. He likewise took notice of several of those meteors called *falling stars*; which appeared as much elevated as when viewed from the plain; a proof, according to Mr Brydone,

Ætna. done, that "these bodies move in regions much beyond the bounds that some philosophers have assigned to our atmosphere."

Extensive prospect. To have a full and clear prospect from the summit of Mount *Ætna*, it is necessary to be there before sunrise; as the vapours raised by the sun, in the day time, will obscure every object: accordingly, our travellers took care to arrive there early enough; and all agree, that the beauty of the prospect from thence cannot be expressed.—Here Mr Brydone and Sir W. Hamilton had a view of Calabria in Italy, with the sea beyond it; the Lipari islands, and Stromboli, a volcano, at about 70 miles distance, appeared just under their feet; the whole island of Sicily, with its rivers, towns, harbours, &c. appeared distinct, as if seen on a map. Massa, a Sicilian author, affirms, that the African coast, as well as that of Naples, with many of its islands, have been discovered from the top of *Ætna*. The visible horizon here is no less than 800 or 900 miles in diameter. The pyramidal shadow of the mountain reaches across the whole island, and far into the sea on the other side, forming a visible track in the air, which as the sun rises above the horizon, is shortened, and at last confined to the neighbourhood of *Ætna*. The most beautiful part of the scene, however, in Mr Brydone's opinion, is the mountain itself, the island of Sicily, and the numerous islands lying round it. These last seem to be close to the skirts of *Ætna*; the distances appearing reduced to nothing.

Division into three zones. This mountain is divided into three zones, which might properly enough be distinguished by the names of *torrid*, *temperate*, and *frigid*; they are, however, known by the names of the *Piedmontese*, or *Regione culta*, the cultivated or fertile region; the *sylvosa*, woody, or temperate zone; and the *Regione deserta*, the frigid or desert zone or region. All these are plainly distinguished from the summit. The *Regione deserta*, is marked out by a circle of snow and ice, which extends on all sides to the distance of about eight miles, beginning at the foot of the crater. Great part of this region is smooth and even. This is immediately succeeded by the *sylvosa*, or woody region; which forms a circle of the most beautiful green, surrounding the mountain on all sides. This region is variegated with a vast number of mountains of a conical form, thrown up by *Ætna* in those eruptions which burst out from its sides. Sir W. Hamilton counted 44 on the Catania side, each having its crater; many with large trees flourishing both within and without the crater. All these, except a few of late date, have acquired a wonderful degree of fertility. The circumference of this zone, or great circle, according to Recupero, is not less than 70 or 80 miles. It is everywhere succeeded by the *Regione culta*; which is much broader than the rest, and extends on all sides to the foot of the mountain. Here terrible devastations are sometimes committed by the eruptions; and the whole region is likewise full of conical mountains thrown up by them. The circumference of this region is, by Recupero, reckoned 183 miles; but we have already given our reasons for rejecting these dimensions.—This region is bounded by the sea to the south and south-east; and on all other sides, by the rivers Semetus and Alcantara, which form the boundaries of Mount *Ætna*.

The woody region descends eight or nine miles below the *Regione deserta*, but differs greatly in the temperature of its climate. Sir W. Hamilton observed a gradual decrease of the vegetation as he advanced; the under part being covered with large timber trees, which grew gradually less as he approached the third region, and at last degenerated into the small plants of the northern climates. He also observed quantities of juniper and tansy; and was informed by his guide, that later in the season (he visited *Ætna* in June 1769) there are a great many curious plants, and in some places rhubarb and saffron in great plenty. In Carrera's history of Catania, there is a list of all the plants and herbs of *Ætna*.

This region is extolled by Mr Brydone as one of the most delightful spots on earth. He lodged for a night in a large cave near the middle, formed by one of the most ancient lavas. It is called *La Spelonca del Capriole*, or the goats cavern; because it is frequented by those animals, which take refuge there in bad weather. Here his rest was disturbed by a mountain thrown up in the eruption 1766. It discharged great quantities of smoke, and made several explosions like heavy cannon fired at a distance; but they could observe no appearance of fire.

This gentleman likewise visited the eastern side of the *Regione sylvosa*, intending to have ascended that way to the summit, and descended again on the south side to Catania, but found it impracticable. On this side, part of the woody region was destroyed in 1755, by an immense torrent of boiling water, which issued from the great crater. Its traces were still very visible, about a mile and a half broad, and in some places more. The soil was then only beginning to recover its vegetative power, which it seems this torrent had destroyed for 14 years. Near this place are some beautiful woods of cork, and evergreen oak, growing absolutely out of the lava, the soil having hardly filled the crevices; and not far off, our traveller observed several little mountains that seemed to have been formed by a late eruption. Each of these had a regular cup, or crater, on the top; and, in some, the middle gulf, or *voragine*, as the Sicilians call it, was still open. Into these gulfs Mr Brydone tumbled down stones, and heard the noise for a long time after. All the fields round, to a considerable distance, were covered with large burnt stones discharged from these little volcanoes.

The woody region, especially the east side, called *Over-Carpinetto*, abounds with very large chestnut trees; the most remarkable of which has been called, from its size, *Castagno di Cento Cavalli*, or chestnut tree of a hundred horse. Mr Brydone was greatly disappointed at the sight of this tree, as it is only a bush of five large ones growing together: but his guides assured him, that all these five were once united into one stem; and Signior Recupero told him, that he himself had been at the expence of carrying up peasants with tools to dig round it, and found all the stems united below ground in one root. The circumference, as measured by Mess. Brydone and Glover who accompanied him, amounted to 204 feet. Here the barometer stood at 26 inches 5 lines and a half, indicating an elevation of near 4000 feet.

The Piedmontese district is covered with towns, vil- *Regione culta.*
lages,

Ætna.

Eruption of boiling water.

Over-grown chestnut trees.

lages, monasteries, &c. and is well peopled, notwithstanding the danger of such a situation; but the fertility of the soil tempts people to inhabit that country; and their superstitious confidence in the saints, with the propensity mankind have to despise danger which they do not see, render them as secure there as in any other place. Here, Sir William Hamilton observes, they keep their vines low, contrary to the custom of those who inhabit Mount Vesuvius; and they produce a stronger wine, but not in such abundance: here also many terrible eruptions have burst forth; particularly one in 1699. At the foot of the mountain raised by that eruption, is a hole, through which Sir William Hamilton descended, by means of a rope, into several subterraneous caverns, branching out, and extending much farther than he chose to venture; the cold there was excessive, and a violent wind extinguished some of the torches. Many other caverns are known in this and the other regions of *Ætna*; particularly one near this place, called *La Spelonca della Palumba*, (from the wild pigeons building their nests there). Here Mr Brydone was told that some people had lost their senses, from having advanced too far, imagining they saw devils and damned spirits.

In this region the river *Acis*, so much celebrated by the poets, in the fable of *Æcis* and *Galatea*, takes its rise. It bursts out of the earth at once in a large stream, runs with great rapidity, and about a mile from its source throws itself into the sea. Its water is remarkably clear; and so extremely cold, that it is reckoned dangerous to drink it: it is said, however, to have a poisonous quality, from being impregnated with vitriol; in consequence of which cattle have been killed by it. It never freezes, but is said often to contract a greater degree of cold than ice.

The following additional particulars relating to the eruptions, magnitude, scenery, and products of this celebrated volcano, are chiefly collected from the *Voyage Pittoresque* of M. Houel, who appears to have surveyed it with greater accuracy than any former traveller.

The form of Mount *Ætna* is that of a cone, very broad at the base, which is more than 40 miles in circumference. From the bottom you ascend ten leagues before reaching its summit on the south side; and on any of the other sides, the way being not so straight, would be considerably longer. *Ætna* is entirely composed of substances that have been discharged from the volcano in its various explosions.

It appears from the quantities of marine bodies deposited all over the under part of *Ætna*, that it must have been once covered by the sea to at least one half of its present height. The whole island of Sicily, and the greatest part of Mount *Ætna*, have been, in our author's opinion, formed under water. But the period when the eruptions from this volcano first commenced, the manner in which the sea subsided, and the precise time at which it fell so low as its present level on the shores of Sicily, are facts concerning which we have no certain knowledge.

The general principle, however, Mr Houel thinks may be regarded as undeniable. When this mountain stood half under water, the currents of the ocean would gradually accumulate upon it large masses, both of its own productions, such as shells, and bones of

fishes, and of various other matters, which would be intermixed with the volcanic matters discharged from the focus of the burning mount. In a long series of ages these strata of heterogeneous matters would naturally become so considerable, as to form the enormous mass of mountains with which the volcano is now surrounded. The currents of the ocean might often convey the volcanic matters to a considerable distance from the volcanic focus. And there are mountains at no small distance from *Ætna*, which seem to have been produced in this manner. Those of *Carlini*, at the distance of 15 leagues, consist chiefly of a mixture of *pozzolana* with calcareous matters. At *Lintini*, and in places around it, there are distinct beds of *pozzolana*, *scoria*, and real lava, as well as others in which all these matters are blended together in a mass of calcareous matter. At *Palazzolo*, about 24 miles from the city of *Syracuse*, the sides of the hills having been cut by the streams which run down them, in many places to a considerable depth, display huge masses of lava, and extensive beds of *pozzolana*. In the neighbourhood of *Noto* there are also volcanic productions to be found.

At *Pachino*, where the island of Sicily forms an angle, there is a range of hills extending for several miles, which consist all of *pozzolana*.

The province of *Val di Noto* is more homogeneous in the matters of which its soil consists, than the two other dales of Sicily. These, in every hill which they contain, exhibit a vast variety of different matters. So amazing, indeed, is that variety, that they may be considered as exhibiting a collection of specimens of all the different materials which enter into the composition of the globe. In those two dales few volcanic productions have been yet observed. But it is not to be inferred for this reason that they contain but few. They may be hereafter discovered in great plenty. In the volcano of water at *Maccalubbe*, between *Aragona* and *Girginti*; in the baths of *Castellamare*, near *Alcamo* and *Segeste*; in the baths of *Termini*; in the isles of *Lipari*; in the hot waters of *Ali*, between *Messina* and *Taormina*, by the lake in the valley of *Caltagirone*; in all these places, which comprehend the whole circumference of Sicily, the influence of the volcano of *Ætna* is, in some measure, felt. Nay, it would even seem, that in these places there are so many volcanic craters. All of these are so disposed as to show that they existed prior not only to the volcanic matters, but to the other substances intermixed with them.

The waters of the sea have, in former times, risen much higher than at present. But how they retreated, or whether they are to continue stationary at their present height, we know not. For more than 2000 years, during which Sicily has been inhabited, and has had cities and harbours, the sea has not been observed either to recede or encroach in any considerable degree.

When the sea subsided from Mount *Ætna*, the mountain must have been covered over with such matters as the sea usually deposits; consequently with calcareous matters. A part of those matters would be indurated by the action of the atmosphere, while the rest would be carried down by the rain waters, and again conveyed into the ocean. The torrents of rain

water

Ætna. water which pour down the sides of Mount Ætna have furrowed its sides, by cutting out for themselves channels; and they have removed from its summit, and are still removing to a further distance, all the extraneous bodies upon it. In many places, they flow at present over a channel of lava, having cut through all the matters which lay above it: still, however, there remain in many places both calcareous matter and other marine productions, which show that this volcano has been once covered by the waters of the ocean. But these are daily wasting away; not only the rains, but men likewise, who carry them off as materials for lime and for building, conspire to deface them.

No fewer than 77 cities, towns, and villages, are scattered over the sides of Ætna. They are most numerous on the south side, where the temperature of the air is milder than on the north. Reckoning those cities, towns, and villages, one with another, to contain each 1200 or 1500 souls, the whole number of the inhabitants of Mount Ætna will then be 92,400, or 115,500. But it is certainly much more considerable.

Account of the north-east side of the mountain.

Plate IV. fig. 1. exhibits a view of the north-east side of the mountain, taken at sea. The lower part presents to the eye very extensive plains entirely covered with lava of different thickness, on which vegetation has not yet made any progress. The nearer the shore the more barren is the ground; while the fertility of the soil increases as we advance farther inwards. The mountain is everywhere full of vast excavations; which our author considers as a proof, that instead of increasing in bulk it is actually in a state of decay and diminution. The vast torrents of lava, which overspread the sides of it from time to time, he considers as insufficient to repair the waste occasioned by rains, rivulets, and torrents flowing down from the summit. Unless the eruptions, therefore, become more frequent than they have been for some time past, he supposes that, by degrees, the height of the mountain must be reduced to that of the surrounding beds of lava. He had not an opportunity of measuring the altitude of Ætna himself; but he observes, that it had been done by the celebrated M. de Saussure, who found the elevation to be 10,036 feet. This was done on the 5th of June 1773, at 20 minutes after seven in the morning. The height of the barometer on the most elevated part at the brink of the crater was 18 inches $11\frac{1}{4}$ lines; which, by the necessary corrections, is reduced to 18 inches $10\frac{7}{8}$ lines. At the same time the mercury at Catania, placed only one foot above the level of the sea, stood at 28 inches $2\frac{1}{6}$ lines; which must be reduced to 28 inches $1\frac{7}{8}$ lines, on account of the necessary correction for the thermometer.

Supposed to be in a state of decay.

Saussure's account of the height of Ætna.

Mountains of calcareous matter.

From Giana our author had an opportunity of contemplating the vast number of calcareous mounts scattered over that part of Ætna; which (he says) "are nothing more than fragments, the slender remains of those enormous masses which have been deposited all around the base of Mount Ætna; and are a very curious monument of the revolutions which this mountain has undergone." They are of a true calcareous nature; and the inhabitants are accustomed to supply themselves with limestone from them. They also use stones of which these mounts are composed for the purposes of building; as the lava is so hard that it can-

not be cut without the greatest difficulty, and they have no other stone in these parts.

Leaving this place, our author travelled over several extensive plains of lava, covered on each side of the way with stunted trees, but without any cultivation: the lava being of that kind which is very unfavourable to the growth of vegetables. Arriving at St Leonardo, he observed the course of the eruption of water which happened in 1755.

This water took its course down the west side of the mountain: and the channel which it cut for itself is still visible. The eruption of water from burning mountains is still much less frequent than that of lava or half vitrified solid matters, ashes, &c. though that of water, and even mixed with the shells of marine animals (though we are not told whether it was salt or not), has sometimes been observed in other volcanoes, particularly Vesuvius. The eruption we now speak of happened in the month of February 1755. It was preceded by an exceedingly thick black smoke issuing from the crater, intermixed with flashes of fire. This smoke gradually became thicker, and the bursts of flame more frequent. Earthquakes and subterraneous thunder convulsed the mountain, and struck the inhabitants of the adjacent parts with the utmost terror. On Sunday the second of March, the mountain was seen to emit a huge column of smoke, exceedingly dense and black, with a dreadful noise in the bowels of the earth, accompanied also with violent flashes of lightning. From time to time there were loud cracks, like the explosions of cannon; the mountain appeared to shake from its foundations; the air on that side next Mascali became very dark, and loud peals of thunder were heard. These seemed to issue from two caverns, considerably below the summit, on the side of the mountain, and were accompanied with violent blasts of wind like a tempest.

These terrible phenomena continued and increased; Ætna seemed ready to swallow up at once all those materials which it had been for so many years disgorgeing, or rather about to sink at once into the bowels of the earth from whence it appeared to have been elevated. The prospect was far beyond any idea that can be given by description of this tremendous scene. The inhabitants were alarmed beyond measure; the sight of the flames driven by the winds against the sides of the mountain, the shocks of the earthquake, and the fall of rocks, struck the imagination with a horror not to be conceived. During this dreadful commotion, an immense torrent of water was emitted from the highest crater of the mountain. The whole summit of Ætna was at that time covered with a thick coating of snow. Through this boiling water directed its course eastward; and, in its passage, met with frightful precipices. Over these it dashed with the utmost violence, adding its tremendous roaring to the complicated horrors of this awful scene. The snow, melting instantaneously as the boiling torrent advanced, increased its destructive power by augmenting its quantity, while the mischievous effects of the heat were scarce diminished, by reason of the immense quantity of boiling liquid which continued to pour from the summit of the mountain.

This boiling torrent having dashed its awful cata-racts from one chain of rocks to another, at length reached

reached the cultivated plains, which it overflowed for a number of miles. Here it divided itself into several branches, forming as many deep and rapid rivers; which, after several other subdivisions, discharged themselves into the sea.

Though the mountain continued to discharge water in this manner only for half an hour, the ravages of it were very terrible. Not only those of common inundations, such as tearing up trees, hurrying along rocks and large stones, took place here, but the still more dreadful effects of boiling water were felt. Every cultivated spot was laid waste, and every thing touched by it was destroyed. Even those who were placed beyond the reach of the torrent, beheld with inexpressible horror the destruction occasioned by it; and though the alarming noises which had so long issued from the mountain now ceased in a great measure, the shocks of earthquakes and the violent smoke which continued to issue from the mountains, showed that the danger was not over. Two new openings were now observed, and two torrents of lava began to make their way through the snow.

On the 7th of March a dreadful noise was again heard in the bowels of the mountain, and a new column of very thick and black smoke began to issue from it. A horrid explosion of small stones succeeded; some of which were carried as far as the hills of Mascali, and great quantities of black sand to Messina, and even quite over the strait to Reggio in Calabria. On the shifting of the wind to the northward this sand reached as far as the plains of Agosta. Two days after the mountain opened again, and a new torrent of lava was discharged; which, however, advanced very slowly towards the plain, moving only at the rate of a mile in a day. It continued to flow in this manner for six days, when every thing appeared so quiet, that the Canon Recupero set out to view the changes which had taken place.

That gentleman's design was to trace the course of the dreadful torrent of water above mentioned. This he was very easily enabled to do by the ravages it had made; and, by following the channel it had cut all the way from the sea to the summit of the volcano, he found that this immense quantity of water had issued from the very bowels of the mountain. After issuing from the crater, and increasing its stream by passing through and melting the snow which lay immediately below the summit, it destroyed in an instant a fine and extensive forest of fir-trees. All of these were torn up by the violence of the current, though many were no less than 24 or 30 inches in diameter. He observed that the great stream had, in its descent, divided itself into four branches; and these had again subdivided themselves into several smaller ones, easily distinguishable by the quantity of sand they had deposited. Afterwards reuniting their streams, they formed many islands, and rivers 900 feet in breadth, and of a depth which could not easily be determined. Proceeding farther down, and still forcing its way among the beds of old lava, the channel of the waters was widened to 1500 feet, until it was again contracted in the valleys as before. Every object which stood in the way of this tremendous torrent was moved from its place. Enormous rocks were not only hurried down, but several of them moved to more elevated situations than

those they formerly occupied. Whole hills of lava had been removed and broken to pieces, and their fragments scattered along the course of the river, and the valleys were filled up by vast quantities of sand which the waters had deposited. Our author observed, that even at the time he visited the mountain, about ten years after the eruption, the whole side of it still bore the marks of this deluge.

On M. Houel's arrival at Jaci Catena, he inquired for the physician of the place; it being customary for strangers to do so who want to learn any thing concerning the curiosities of the country, as the physicians there are generally those who have any pretensions to literature. By this guide he was shown a well which they call *Holy Water*. There is a flight of steps from the surface of the ground to that of the water. This well itself is 20 feet wide and 40 feet deep. It is supplied by three different springs, each of which is said to have a peculiar taste. The physician informed our author, that one of them resembled milk in its taste; another tasted like soap; and the third had the taste of common water: but our author, after tasting each of them, could not find any remarkable difference.

In his way to La Trizza, our author discovered some very ancient baths with stoves. They had been built here on account of a spring of warm sulphureous water, supposed to be excellent for the cure of cutaneous disorders; and for which purpose they are still made use of. They are now called the *Springs of St Venera*, of whom there is an image here. The fountain from which they flow is on a level with the surface of the ground. The water tastes very disagreeably of sulphur; and deposits a quantity of white impalpable powder, adhering to herbs and stones over which it passes. This substance our author calls the *cream of sulphur*; though it is probably a selenitic substance formed by the decomposition of the sulphur, and the union of its acid with some calcareous matter which held it in solution before.

From this place our author proceeded to the sea-port of Trizza, a small place, which with the adjacent country contains only about 300 inhabitants. Off the harbour of this place is a basaltic rock, which seems to be only the remains of a much larger one destroyed by the action of the air. All round are long ranges of basaltes, the species of which are very various.

The rocks of the Cyclops stand round the small harbour of La Trizza; and from this view we perceive a number of rocks of very different heights. All of them appear more or less above water, though some are so low that they cannot be seen without approaching very near; and this circumstance renders the harbour inaccessible to vessels of any considerable burden, at the same time that, by reason of the depth of the sea, it is impossible either to cut or unite them by a mole. The principal of these rocks is the extremity of an island, one half of which is composed of lava placed on a basaltic base; over this is a crust of pozzolana, combined with a kind of white calcareous matter of a pretty hard and compact consistence; and which, by the action of the air, assumes the appearance of knotty porous wood. On this subject our author observes, that "the rock at some former period, had become so hard as to split, and the clefts were then filled with

Ætna

Account of a remarkable well.

Ancient baths discovered:

Springs of St Venera.

Basaltic rocks about Trizza.

Rocks of the Cyclops.

Ætna. with a very hard matter which was porous on all sides like scorizæ. That matter afterwards split also; leaving large interstices, which in their turn have been filled up with a kind of compound yellow matter. The island appears to have been formerly inhabited, but is at present destitute both of inhabitants and of culture, only the people of La Trizza feed a few goats upon it."

Different kinds of basaltæ. To the southward of the harbour of La Trizza we observe several fragments of basaltæ, both in the form of needles, and in that of prismatic columns of a very regular form, and which may be easily separated from one another. From the position in which these fragments are disposed, it appears that the mass to which they belong must have suffered some very violent shock; otherwise such huge rocks could never have been broken, overturned, and scattered in directions so very different from their original positions. In one of these ruins there are some parts harder than the rest, which withstand the action of the air, while the intervening spaces yield to it, and appear to be thus destroyed. In some others this effect is much more remarkable; because the columns happen to be much farther advanced towards a state of dissolution, the parts of which they consist being already disjointed; and in each of those which project we perceive a fissure: which shows that each of these parts may be divided into two. "They are indeed (says our author) actually divided, and display a convexity issuing from a concavity, like a pile of hats placed one upon another, when they are removed one by one; which is a very curious singularity."

Promontory of the Castel d'Aci described. Continuing his journey still southward, our author arrived at the promontory of the Castel d'Aci. This is the most singularly curious of all that are in the neighbourhood of Ætna. The ancient mass of it is in enclosed between two bodies of lava of a more modern origin. These compose the rocks on which Castel d'Aci is situated, and which lie under the soil of the adjacent country. Beyond that city are the immense plains of the lower part of Ætna. These gradually rise till they reach the summit, which is hid among the clouds. The promontory is almost entirely composed of basaltæ, the interstices of which are filled up with a yellowish matter, which seems to be a clay nearly of the same nature with that formerly taken notice of in the island of La Trizza. It also covers the mass of basaltæ, and has produced both the superior and anterior parts of the promontory. Here our author saw a number of women employed in washing webs of cloth in the sea; and takes notice of the dexterous method they have of lifting it up in folds, and packing it on their heads in bundles, without receiving any assistance. At the foot of this promontory are many curious basaltic rocks.

Great quantity of basaltæ found on Ætna. All along the eastern side of Mount Ætna the soil is broken, but filled with beautiful varieties of basaltæ, highly worthy of observation. Indeed, according to our author's opinion, there is no volcano in Europe so rich as Ætna in basaltæ, nor where so many curious figures of it are to be seen.

M. Houel's journey to the great chesnut tree. M. Houel having spent some more time in visiting the basaltic columns around the foot of the mountain, set out from Aci to visit the famous *chesnut tree* for an hundred horses which we have already mentioned. In

his way thither he passed through the villages of For-
tezza, Mangano, St Leonardo, St Matteo, and La
Macchia. The landscapes of each of these places by
itself are extremely beautiful; but the country between
them is a frightful wild desert, presenting to the eye
nothing but extensive plains of black lava, which at a
distance have the appearance of vast quantities of pit-
coal. The roads became rougher as they advanced;
but the adjoining fields assumed a more pleasing aspect.
The reason of this is, that the torrents of lava (by which
the plains are rendered unfit for vegetation for a great
number of years) have rolled rapidly down the more
steep sides of the mountain without destroying the fer-
tility of the soil.

Travelling through very difficult roads, and often
inconmoded with dangerous precipices, our author at
last arrived at the celebrated chesnut tree, which was
the chief object of this journey. He observes, that,
all over this side of the mountain, the chesnut trees
thrive very well, and are carefully cultivated by the in-
habitants. They are worked into hoops for casks, and
a considerable trade is carried on in this article. The
great one which he came to visit, exceeds the size of
other trees so much, that it cannot fail to excite the
greatest admiration. It has its name from the follow-
ing circumstance. Jean of Arragon spent some time in
Sicily on her way from Spain to Naples. While here,
she visited Mount Ætna, attended by her principal no-
bility; and happening to be overtaken by a storm,
they took shelter under this tree, whose branches were
sufficiently extensive to cover them all. By others,
however, this story is treated as a mere fable.

According to our author's account, this chesnut tree
is 160 feet in circumference, which is less than Mr Bry-
dson's account of it, but quite hollow within: which,
however, affects not its verdure; for the chesnut tree,
like the willow, depends upon its bark for subsistence,
and by age loses its internal part. As the cavity of
this enormous mass is very considerable, the people
have built a house in it, where they have an oven for
drying nuts, almonds, and chesnuts, &c. of which they
make conserves. They frequently supply themselves
with wood from the tree which encircles their house,
so that it seems likely, in a short time, to go to ruin
through the thoughtless ingratitude of its inhabitants,
to whom it gives protection.

It has been thought that this tree was composed of
a number of others grown together; but our author is
of a different opinion. For he supposes that the bark
and outer part of the wood have been rent asunder,
and that by a natural motion the divided parts of the
bark seeking to reunite, or rather to shelter themselves
from the action of the external air, are bent inwards so
as to form circular arcs, which may indeed be taken for
so many different trees, though they appear properly to
belong to the same trunk.

Besides this, there is abundance of other trees in
the neighbourhood very remarkable for their size.
Our traveller was shown a number of young trees of
the same species, all very beautiful and straight, and
almost as smooth as polished marble. One of these
was 38 feet in circumference, and there was a num-
ber of others nearly of the same size. Among these
there were seven standing together, which have receiv-
ed the name of the *seven brethren*. Another is de-
nominated

minated the ship, from the general figure of its top, which has some slight resemblance to a ship. Its diameter is 25 feet, so that the circumference cannot be less than 75. In these extensive forests, however, there are chesnut trees of every age and size.

Our author's next visit was paid to a snow grotto, being one of those magazines, where that article, so necessary in the hot climate of Sicily, is preserved for use. In his way thither he visited the forest of pines; which is so much surrounded by rocks and precipices, that it is scarcely accessible; and vast numbers of the trees are dying of old age. Some of the neighbouring peasants, however, now and then attempt to carry them off. Our author saw one of them at this work. It was drawn by oxen, who were yoked to it by a chain connected with the beam by an iron cramp. But the extreme roughness of the road made the tree leap and bound in such a manner, that the poor creatures were every moment in danger of having their legs broken, or being hurried over precipices along with their driver; accidents which happen not unfrequently, and which render this occupation less generally practised than otherwise it would be.

The snow grotto is but lately formed, by the action of the waters under the beds of lava carrying away the stratum of pozzolana below them. It is situated on a mount named *Finocchio*, which, though of very considerable size, is only a protuberance on the side of *Ætna*. It has been repaired in the inside at the expence of the knights of Malta, who have hired this, as well as several other caverns in the mountain, for the purpose of holding snow, which they have still more occasion for in their island than the inhabitants of Sicily. There are two openings above, at which they throw in the snow; and flights of steps have been cut to these as well as in the internal parts. A considerable extent of ground is levelled and enclosed with high walls above the grotto; so that when the wind, which at this elevation blows with great violence, carries the snow down from the higher parts of the mountain, it is stopped and detained by the walls of this enclosure. It is then thrown into the grotto, where the thickness of the beds of lava which cover it prevents any impression from the summer heat. When the season for exportation comes on, the snow is put into large bags, and pressed into them as close as possible. Thus it is rendered compact and heavy, and likewise runs less risk of being affected by the heat. It is then carried out upon men's shoulders, and conveyed to the shore on mules. Before it is put into the bags, the lumps of snow are carefully wrapped up in leaves, which is another preservative; at the same time that the fresh congelation of the little which melts, unites the masses so together, that our author informs us he has seen pieces of the snow preserved in this manner which looked like the fairest and most transparent crystal.

Our author's next excursion was to Mount Rosso, or the Red Mountain, which is one of the mouths of *Ætna*, and through which it discharges from time to time great quantities of lava, sand, ashes, &c. It is the most celebrated of all the numerous mouths which have opened on the side of the mountain, though it has become so noted only for having poured forth the matter of the great eruption in 1669, and which is the most remarkable of any recorded in history.

"When a new crater (says our author) is formed on Mount *Ætna*, it is always in consequence of some shock that is powerful enough to break the arches of its caverns. Doubtless it is inconceivable that there should be any agent endowed with such force; but when such a fracture is once made, it is necessarily very large, and the surface of the ground above cannot but be broken in several different places at considerable distances from one another. The matter which is discharged always issues from the principal opening and those adjoining to it. None of these mouths, however, continue open, excepting that which is directly in the line in which the matter is discharged; the lava soon choking up those which are in a more oblique direction."

Ætna.
New craters how formed.

Our author went down one of these openings with torches; but could not reach the bottom, and was obliged to return on account of the extreme cold. The descent was extremely difficult, and became more so in proportion as he advanced. This crater is of an oval form, and the opening through which he descended was in one extremity: but he was tempted to think that the crater which rises above it had been formed of matter discharged by another mouth: or perhaps it might have had a more central opening, through which the stones, sand, &c. which form the crater were discharged.

Four of the mouths of this mount appear to be composed of a reddish pozzolana, which has procured it the name of the *Red Mountain*; but when we ascend the pyramids, or rather funnels which they form, we find them composed of different-coloured layers of sand. Some of these are of a bluish-gray colour, others of a fine yellow, and some of a kind of green formed by a mixture of gray and yellow, while others are of red colour. A great number of small crystals, black schoerls, and granites are found among them, as well as pieces of scoria, which had been discharged by the volcano in the form of a thick and glutinous matter. All these mouths have internally the form of a funnel, and their shape is nearly that of a mutilated cone or round pyramid. This is the natural and unavoidable consequence of the perpendicular fall of the pulverized matter which the volcano discharges from the orifice at the bottom. The sides of the craters are not all of one height; the parts to the east and west being considerably higher than the intermediate summits, because the currents of the ashes passed alternately from east to west, and fell upon these sides in greater quantities than on the others; which circumstance has given to the volcano the appearance of having two summits.

M. Houel, having finished his observations on Monte Rosso, returned to the convent of Nicolosi, which is now only a house for the entertainment of travellers. The Benedictines of Catania, to whom it belongs, visit this place only when in an ill state of health, as the purity of the air renders it very salutary to the human constitution. A solitary brother, however, resides here to take care of the house, and to superintend the cultivation of the neighbouring plains. Those fathers once possessed an extensive and very fertile tract of land in this neighbourhood; but the eruptions of *Ætna* have rendered it totally incapable of cultivation. This house stands at a very considerable height, being no less than 2496 feet above the level of the sea. Setting

Ætna.
Grotto of
the Goats
described.

ting out from this place three hours before day, our traveller directed his course towards the Grotto of the Goats. In his way thither, he passed over several plains of lava, some of them ancient and others more modern: but the roads were extremely rough and dangerous; or rather, as our author expresses himself, there was no track or path meriting the name of a road. In two hours they reached the Regione Sylvosa, where an immense forest surrounds the mountain, and which has undoubtedly been planted by the hand of nature: for there the ground is so high, so full of precipices, and so entirely uninhabitable, that no human being could ever think of making plantations on it; nor is it to be supposed that the winds could take up seeds from the plains to sow them on such a lofty situation.

Beautiful
appearance
of the fo-
rests of
Ætna.

These majestic forests of Ætna afford a singular spectacle, and bear no resemblance to those of other countries. Their verdure is more lively, and the trees of which they consist are of a greater height. These advantages they owe to the soil whereon they grow; for the soil produced by volcanoes is particularly favourable to vegetation, and every species of plants grows here with great luxuriance. In several places, where we can view their interior parts, the most enchanting prospects are displayed. The hawthorn trees are of an immense size. Our author saw several of them of a regular form, and which he was almost tempted to take for large orange trees cut artificially into the figures they represented. The beeches appear like as many ramified pillars, and the tufted branches of the oak like close bushes impenetrable to the rays of the sun. The appearance of the woods in general is exceedingly picturesque, both by reason of the great number and variety of the trees, and the inequality of the ground, which makes them rise like the seats in an amphitheatre, one row above another; disposing them also in groups and glades, so that their appearance changes to the eye at every step; and this variety is augmented by accidental circumstances, as the situation of young trees, among others venerable for their antiquity; the effects of storms, which have often overturned large trees, while stems shooting up from their roots, like the Lernean hydra, show a number of heads newly sprung to make up that which was cut off.

Grotto of
the Goats
how form-
ed.

About three hours after the departure of our travellers from St Nicholas, they reached the Grotto of the Goats. It is formed by a bed of lava, which having flowed over a pile of sand and pozzolana while in a fluid state, settled and cooled in that situation; and the sand or pozzolana being afterwards carried off by the filtration of water through the lava, a void space has been left, which the torrents have gradually enlarged to its present size.

This grotto stands about 5054 feet above the level of the sea, according to the calculations of M. de Saussure. It affords a retreat for those travellers who visit the summit of Ætna, who generally refresh themselves by taking a repast and making a fire at the entry, for which there is plenty of dry wood at hand; while the sand serves for a bed to repose on. Here our author and his company supped, and about midnight set off for the summit. They had the advantage of the moon-light; and our author advises all those who intend to visit the top of Ætna, to take such a time for

their journey as may enable them to enjoy this advantage. As they advanced beyond the Grotto of the Goats, the trees became gradually thinner. In a short time they were so thin, that they might readily be counted; and, proceeding still farther, only a very few were seen scattered here and there, whose beauty and size were diminished seemingly in proportion to their numbers. A few clumps of trees and some tufts of odoriferous herbs were now only to be seen; and in a little time these also became thinner, assuming a withered or stunted appearance. There they are nothing but the languishing remains of an abortive vegetation; and a few paces further even this disappeared, and the eye was presented only with barren sand.

Having now got above the region of the trees, they entered the third, which our author denominates the region of snow and sterility. The wind became more brisk and keen as they advanced, so that they could scarce keep their hats upon their heads; and our author lost his, though tied on with a handkerchief. Here they were frequently obliged to cross considerable streams of water formed by the melting of the snow. In general the surface was sufficiently hard to bear them; but our author's mule once sunk up to her belly, and was not extricated without great difficulty.

Having at last overcome all difficulties, they arrived at the large plain on the summit of Ætna, and in the midst of which is the crater of the volcano. It is entirely composed of lava, cinders, ice, and snow; and has been styled, ironically as our author thinks, *Monte Frumente*. Here the wind continued to blow with excessive violence; and our author informs us, that in order to have any notion of its keenness, we must be accustomed to feel it on some very elevated station, as it is impossible to judge from what we feel at inferior altitudes. They took shelter behind a lump of lava, the only one which appeared in the whole plain, and, which our author says, would seem designed expressly for the shelter of travellers. Here they lay, wrapped up in their cloaks, for an hour: but as soon as it was day, so that they could distinguish the place where the sun was to rise, they got up and advanced towards the ruins of the building known by the name of the *Philosopher's Tower*. The wind still blew so violently, that after an effort of four minutes they fell down exhausted: but the extreme cold obliging them again to get up, they made a second attempt; and after several intermissions of this kind, at last accomplished their design. They were surprised, however, to find nothing but the corner of a wall not more than two feet high, consisting of two rows of unpolished stones; great part of it having been probably buried by the sand and other matters discharged by the mountain. Here, being sheltered from the wind, and the day advancing, they began to enjoy the glorious prospect which every moment became more extensive. At the rising of the sun, the horizon was serene, without a single cloud. "The coast of Calabria (says our author) was as yet undistinguishable from the adjoining sea; but in a short time a fiery radiance began to appear from behind the Italian hills, which bounded the eastern part of the prospect. The fleecy clouds, which generally appear early in the morning, were tinged with purple; the atmosphere became strongly illuminated, and, reflecting the rays of the rising sun, appeared filled with a bright effulgence of

Ætna.
Account
the high-
parts of
Ætna.

Snowy a
barren re-
gion de-
scribed.

Plain of
the sum-
mit of Ætna.

Wind ex-
cessive-
violent
here.

Exten-
sive pro-
spect.

Ætna. of flame. The immense elevation of the summit of *Ætna* made it catch the first rays of the sun's light, whose vast splendour, while it dazzled the eyes, diffused a most cherishing and enlivening heat, reviving the spirits, and diffusing a pleasant sensation throughout the soul. But though the heavens were thus enlightened, the sea still retained its dark azure, and the fields and forests did not yet reflect the rays of the sun. The gradual rising of this luminary, however, soon diffused his light over the hills which lie below the peak of *Ætna*. This last stood like an island in the midst of the ocean, with luminous points every moment multiplying around, and spreading over a wider extent with the greatest rapidity. It was as if the universe had been observed suddenly springing from the night of non-existence. The tall forests, the lofty trees and extensive plains of *Ætna*, now presented themselves to view. Its base, the vast tracts of level ground which lie adjacent, the cities of Sicily, its parched shores, with the dashing waves and vast expanse of the ocean, gradually presented themselves, while some fleeting vapours, which moved swiftly before the wind, sometimes veiled part of this vast and magnificent prospect." In a short time every thing was displayed so distinctly, that they could plainly recognize all those places with which they were before acquainted. On the south were seen the hills of Camerata and Trapani; on the north, the mounts Pelegrino and Thermini, with the celebrated Enna, once crowned with the temples of Ceres and Proserpine. Among these mountains were seen a great many rivers running down, and appearing like as many lines of glittering silver winding through a variety of rich and fertile fields, washing the walls of 28 cities, while their banks were otherwise filled with villages, hamlets, &c. rising among the ruins of the most illustrious republics of antiquity. On the south and north were observed the rivers which bound by their course the vast base of Mount *Ætna*, and afford a delightful prospect to the eye; while at a much greater distance were seen the islands of Lipari, Alicudi, Felicicide, Parinacia, and Stromboli.

Having enjoyed for some time the beauty of this magnificent prospect, our author set about making a draught of the place from which the view was taken; and at length accomplished it, notwithstanding the great impediments he met with from the wind. Among the objects which he delineated on this occasion, the Philosopher's Tower was one. It seems, he says, not to be very ancient; neither the materials of which it consists, nor the mode of architecture, bearing any resemblance to those of the Greeks and Romans. The surrounding plain seems to consist entirely of a black sand intermixed with pieces of scoria, which have been formerly thrown out by the volcano. Beyond that plain, which rises gently, appears a cone, the summit of which is the volcanic crater. When viewed from the south side, on which they stood, this crater seems to consist of a number of small hills. Into these it was broken by the emission of the boiling torrent in the year 1755. When discharged from the crater, these waters spread towards the right, and at the distance of a mile eastward fell in a cascade from a prodigious height.

The violence of the wind beginning now to abate a

little, the travellers set out for the very summit, in order to take a view of the great crater; in which journey (our author says) it would be difficult to make people, who have never engaged in such enterprises, comprehend all the obstacles they had to encounter. This cone (the little mountain mentioned by Sir William Hamilton) is composed of ashes, sand, and pozzolana, thrown up at different times by the volcano. The materials are so loose, that the adventurous traveller sinks about mid-leg at every step, and is in constant terror of being swallowed up. At last, when the summit is reached, the sulphureous exhalations, which are continually emitted from the pores of the mountain, threaten suffocation, and irritate the fauces and lungs in such a manner as to produce a very troublesome and incessant cough. The looseness of the soil, which gives way under the feet, obliges the traveller, every now and then, to throw himself flat on his belly, that so he may be in less danger of sinking. In this posture our author viewed the wide unfathomable gulf in the middle of the crater; but could discover nothing except a cloud of smoke, which issued from a number of small apertures scattered all around, and accompanied with a kind of noise. Another and more dreadful sound, however, issues from the bowels of the volcano, and which, according to our author, "strikes the heart with terror, so that all the strength of reason is necessary to prevent the observer from flying with precipitation from such a dreadful place." Several travellers who had visited this cone before him, were so terrified by these dreadful sounds, that they fled with the utmost haste till they arrived at the foot of the mountain.

Our author compares these sounds to a discharge of cannon in the wide abyss; the noise of which is rebellowed throughout all the caverns, and produces a sound perhaps the most alarming that can be imagined; and during the short space in which he listened, several of these discharges were heard to follow one another almost uninterruptedly.

This dreadful noise, our author, with very great probability, supposes to be occasioned by the explosions of the internal fire, or, as he calls it, the *focus* of the volcano: which, striking against the sides of these immense caverns, the sounds produced are re-echoed through their cavities, and probably multiplied in an extraordinary manner; so that what would be only a slight explosion in the open air, occasions a sound more tremendous than the loudest thunder. To such as are convinced of this, and have sufficient courage to resist the first impressions which these sounds must unavoidably occasion, they will in a short time not only appear exceedingly sublime, but by their variety, even somewhat agreeable. "They enable us (says our author) to form some conception of the space through which they must pass before they reach the ear, and of the vast extent and width of the hollows of the mountain."

Having for some time contemplated this awful spectacle, our author wished to measure the crater by walking round it, but found this impossible. On the north side the surface is hard and smooth, the ashes having been so far dissolved by the moisture deposited by the smoke as to cement into one uniform mass. This is sometimes dissolved even into a fluid state, in such a manner

Ætna.

Horrid noises issue from the burning gulf.

Philosopher's Tower described.

Description of the great crater.

Impossible to walk round the crater.

Ætna. manner as to run down the sides of the cone; so that, after several attempts, he was at last obliged to abandon his design.

Figure of
the crater.

Fig. 2. exhibits a view of the crater of Ætna taken on the brink of the east side. The fore ground (*aa*) of the figure is one division of the crater. Beyond it are two eminences *b* and *c*, higher than that on which some human figures are represented. All the three form a triangle nearly equilateral; but, when viewed from any considerable distance, only two of them can be seen; for which reason the Sicilians have termed the mountain *bicorne*, or double-horned.

The smoke, as represented in the figure, issues from all quarters, either from chinks or holes scattered over the whole crater. But the situation of the principal mouth is in the midst of the three eminences. Its diameter, when our author visited this mountain, was only about 60 feet, and so filled with smoke, that nothing remarkable could be discovered. From the height *d*, the rock situated on the left side of the print, and on which the human figures are represented, all the way to the rock *e* on the right, the distance is no more than 900 feet. Our author observed, that the cone is not exactly in the middle of the plain, but is situated more towards the north than the south. He did not attempt to cross the central valley *f*, on account of the looseness of the ground, and that there was no object apparently worthy of the risk he must run in so doing. At the nearest view he took, it was only observed that there was snow lying in several parts of it, though the heat which otherwise prevailed seemed to be very intense.

The smoke which issues from the crater of Ætna is generally carried in a direction from south to north; and, as it brings along with it a considerable quantity of water, the latter, condensed by the cold winds, runs down the side of the mountain in plentiful streams, and often leaves pretty permanent marks of its course.

Eruption of In this manner he accounts for the great eruption of water in 1755, which he supposes to have been occasioned only by an unusual quantity of water falling into the burning focus of the mountain, there rarefied into steam, and afterwards condensed by the coldness of the atmosphere.

South wind Like other travellers to Mount Ætna, this gentleman found the wind blowing from the south, and he is of opinion, that a south wind blows here more frequently than any other, as he did not observe any channels cut by the water on any other side than the north. He had several opportunities of making this observation, having frequently visited the top of Ætna, and always paid attention to the crater. The sand on the east and west sides was always loose, while that on the north was compacted into a solid body. The three summits were of a later date than the rest of the crater, having been probably thrown up by some eruption which had burst it asunder. The black spots on the fore ground represent a number of hillocks about the size of mole-hills, from which a sulphureous vapour constantly issues, and by which the adjacent ground is tinged of an ochrey colour. This vapour issues from the crevices with a kind of hollow whistling noise; which, with the volcanic thunder, smoke, and noxious smell, render it very disagreeable to stay here even for a few moments.

The smoke is represented in the figure precisely as it appeared on the day that he ascended, which was very

warm. But it does not always rise in this manner; for when the cold is very intense, it collects into a body, and thickens around the edge of the crater: on which occasion it is condensed into water, which diffuses itself around the edge of the crater, and mixing with the ashes converts them into a kind of clay. The cold on the top of this mountain is so intense, that travellers very often find their clothes insufficient to protect them; and it is remarkable that such intense cold is always produced by a south wind. The day that our author took his draught, the wind blew faintly from the north.

The base of Mount Ætna, according to M. Houel's Account observations, consists of alternate layers of lava and marine substances, which have been deposited successively one upon another. These alternate layers extend to an unknown depth. They must needs go as far down as the level of the stratum of lava which was discharged by the volcano at its first origin. The last deposited by the sea is a range of calcareous mountains of a considerable height, and which are placed on a basis of lava. Beneath that layer of lava is another of sea pebbles, which are well known to be rounded by their attrition against one another by the motion of the waves. This layer is of a considerable depth, and lies upon a yellowish rock consisting of a species of indurated sand. The river Simeto flows over this rock, which it has cut away considerably. That part which is at present the bed of the river is much higher than the base of Ætna that is on a level with the sea; and not the least thing occurs to suggest an idea of what has been the primary base of the volcano. The marine substances, already taken notice of, lie nearly in a horizontal direction, more or less so according to the nature of the surface on which they have been deposited.

Ætna abounds very much with springs, fountains, and even rivers of considerable magnitude. Our author has computed, that if all the water flowing down the sides of this mountain were collected, it would fill the channel of a river 36 feet broad and 6 in depth. Many of the springs afford fine salt; some are very pure, and others are impregnated with noxious substances; while others are remarkable for their use in dyeing particular colours.

"It is worthy of notice (says our author), that streams of water, some of them more copious, others more scanty, are seen to issue at all different degrees of height, from the base to the summit of the mountain. Even in summer, when very little rain falls for three or four months, or when perhaps for that space there is no rain at all, and for three of which, at least, there is not an ounce of snow melted; even then a great number of rivulets continue to flow down the sides of Ætna; and at the same time a number of streams, external and subterraneous, each of them several feet wide, are, according to the accounts of the country people, plentifully supplied with water.

"As the trifling quantity of snow which is melted here even in the midst of summer, and the still smaller quantity deposited by the clouds, would be totally insufficient to supply those streams, and must be all absorbed by the earth for the support of vegetation, those streams must proceed from some other cause, whose effects are more copious and permanent.

Ætna.

Intense cold produced by a south wind.

Account the strat at the foot of Mount Ætna.

Great number of Mount Ætna.

When such a quantity of water is received.

Fig. 1.



Fig. 2.



Eng^d by R. Scott

Thunder and lightning from the smoke.

Thunder
and light-
ning from
the smoke.

We shall close this article with an enumeration of all the different eruptions from Mount Ætna which are found upon record.

1. The first mentioned in history, is that of which Diodorus Siculus speaks, but without fixing the period at which it happened. That eruption, says he, obliged the Sicani, who then inhabited Sicily, to forsake the eastern, and retire to the southern part of the island. A long time after that, the Sicilians, a people of Italy, migrated into Sicily, and took up their abode in that part of the island which had been left desert by the Sicani.

2. The second eruption known to have issued from this volcano, is the first of the three mentioned by Thucydides; of none of which he fixes the date, mentioning only in general, that from the arrival of the first Greek colonies that settled in Sicily (which was in the 11th Olympiad, and corresponds to the 734th year before the Christian era, to the 88th Olympiad, or the year 425 before Christ, *Ætna* at three different times discharged torrents of fire. This second eruption happened, according to Eusebius, in the days of Phalaris, in the 565th year before the Christian era. The assertion of Eusebius is confirmed by a letter from that tyrant to the citizens of Catania, and the answer of the Catanians (if, after Bentley's Dissertations against their authenticity, any credit be due to the Epistles of Phalaris). But Diodorus gives both these pieces.

3. The third, which is the second of the three mentioned by Thucydides, happened in the 65th Olympiad.

Ætna. piad, in the 477th year before the Christian era, when Xantippus was archon at Athens. It was in this same year the Athenians gained their boasted victory over Xerxes's general Mardonius near Plataea. Both the eruption of the volcano and the victory of the Athenians are commemorated in an ancient inscription on a marble table which still remains. An ancient medal exhibits a representation of an astonishing deed to which that eruption gave occasion. Two heroic youths boldly ventured into the midst of the flames to save their parents: their names, which well deserved to be transmitted to future ages, were Amphinomus and Anapius. The citizens of Catania rewarded so noble a deed with a temple and divine honours. Seneca, Silius Italicus, Valerius Maximus, and other ancient authors, mention the heroism of the youths with just applause.

4. The fourth eruption, the third and last of those mentioned by Thucydides, broke out in the 88th Olympiad, in the 425th year before the Christian era. It laid waste the territory of Catania.

5. The fifth is mentioned by Julius Obsequens and Orosius, who date it in the consulship of Sergius Fulvius Flaccus and Quintus Calpurnius Piso, nearly 133 years before the Christian era. It was considerable; but no peculiar facts are related concerning it.

6. In the consulship of Lucius Æmilius Lepidus and Lucius Aurelius Orestes, in the 125th year before the Christian era, Sicily suffered by a violent earthquake. Such a deluge of fire streamed from Ætna as to render the adjoining sea into which it poured absolutely hot. Orosius says, that a prodigious quantity of fishes were destroyed by it. Julius Obsequens relates, that the inhabitants of the isles of Lipari ate such a number of those fishes, as to suffer, in consequence of it, by a distemper which proved very generally mortal.

7. Four years after the last mentioned, the city of Catania was desolated by another eruption, not less violent. Orosius relates, that the roofs of the houses were broken down by the burning ashes which fell upon them. It was so dreadfully ravaged, that the Romans found it necessary to grant the inhabitants an exemption from all taxes for the space of ten years, to enable them to repair it.

8. A short time before the death of Cæsar, in the 43d year before Jesus Christ, there was an eruption from Mount Ætna. Livy mentions it. It was not distinguished by any thing extraordinary. It was afterwards considered as an omen of the death of Cæsar.

9. Suetonius, in the life of Caligula, mentions an eruption from Mount Ætna which happened in the 40th year after the Christian era. The emperor fled on the very night on which it happened, from Messina, where he at that time happened to be.

10. Carrera relates, that in the year 253, there was an eruption from Mount Ætna.

11. He speaks of another in the year 420; which is also mentioned by Photius.

12. In the reign of Charlemagne, in the year 812, there was an eruption from Ætna. Geoffroy of Viterbo mentions it in his Chronicle.

13. In the year 1269, on the 4th February, about day-break, there was an earthquake in Sicily, which was felt as far as Reggio, on the opposite side of the strait. Catania was reduced by it to ruins; and in

that city more than 15,000 souls perished. The bishop, with 44 monks of the order of St Benedict, were buried under the ruins of the roof of the church of St Agatha. Many castles in the territories of Catania and Syracuse were overturned; new rivers burst forth, and ancient rivers disappeared. The ridge of the mountain was observed to sink in on the side next Taormino. The spring of Arethusa, so famous for the purity and sweetness of its waters, then became muddy and brackish. The fountain of Ajo, which rises from the village of Saraceni, ceased to flow for two hours; at the end of which the water gushed out more copiously than before. Its waters assumed a blood colour, and retained it for about an hour. At Messina, the sea, without any considerable agitation, retired a good way within its ordinary limits; but soon after returning, it rose beyond them, advanced to the walls of the city, and entered the streets through the gates. A number of people who had fled to the shore for safety were swallowed up by the waves. Ludovico Aurelio relates, that the vines, corn, and trees of all sorts, were burnt up, and the fields covered over with such a quantity of stones as rendered them unfit for cultivation.

14. Twelve years after this, in the year 1281, a dreadful eruption issued from Ætna on the east side. Streams of fire ran down the declivity of the mountain, and encircled the church of St Stephen, but without burning it.

Nicholas Speciale, who relates, though he did not see, this event, was witness to another conflagration on Ætna 48 years after this, in the year 1329, on the 23d of June, of which he has given a description.

15. On that day, says he, about the hour of vespers, Ætna was strongly convulsed, and uttered dreadful noises; not only the inhabitants of the mountain, but all Sicily, were struck with consternation and alarm. On a sudden, a terrible blaze of fire issued from the southern summit, and spread over the rocks of Mazzara, which are always covered with snow. Together with the fire, there appeared a great deal of smoke. After sunset, the flames and the stones that issued out with them were seen to touch the clouds. The fire making way for itself with the most furious impetuosity, burnt up or reduced to ruins all those structures which the piety of former times had consecrated to the Deity. The earth yawning, swallowed up a great many springs and rivulets. Many of the rocks on the shore of Mascali were shaken and dashed into the sea. A succession of these calamities continued till the 15th of July, when the bowels of Ætna were again heard to rebel. The conflagration of Mazzara still went on unextinguished. The earth opened near the church of St John, called *Il Paparinacca*; on the south side fire issued from the gap with great violence: to add to the horrors of the day, the sun was obscured from morning to evening with clouds of smoke and ashes, as entirely as in an eclipse. Nicholas Speciale went towards the new-opened crater, to observe the fire and the burning stones which were issuing from the volcano. The earth rebellowed and tottered under his feet; and he saw red-hot stones issue four times successively in a very short space from the crater, with a thundering noise, the like of which, he says, he had never before heard.

Ætna.

In a few days after this, all the adjacent fields were burnt up by a shower of fire and sulphureous ashes; and both birds and quadrupeds being thus left destitute of food, died in great numbers. A great quantity of fishes likewise died in the rivers and the contiguous parts of the sea. "I cannot think (says he) that either Babylon or Sodom was destroyed with such awful severity."—The north winds, which blew at the time, carried the ashes as far as Malta. Many persons of both sexes died of terror.

16. Scarce had four years elapsed after this terrible event, when Ætna made a new explosion, and discharged volleys of stones, causing the neighbouring fields to tremble. This happened in the year 1333.

17. Forty-eight years after this, on the 25th of August 1381, an eruption from Ætna spread its ravages over the confines of the territory of Catania, and burnt up the olive yards in the neighbourhood of that city.

18. In the year 1444, 63 years after the last eruption, a torrent of lava issued from Ætna and ran towards Catania. The mountain shook; and the shocks were so violent, that several huge masses of rock were broken from its summit, and hurled into the abyss with a tremendous noise.

19. After this Ætna was scarce at rest for 18 months or two years. On Sunday the 25th of September 1446, about an hour after sunset, an eruption issued from the place called *La Pietra di Mazarra*. This eruption was soon over.

20. In the following year, 1447, on the 21st of September, there was another, with a good deal of fire; but this eruption was likewise of short duration.

21. Ætna now ceased to emit fire, and that for a considerable time. The neighbouring inhabitants not only ascended to the summit of the mountain, but even, if we may credit accounts, went down into the fiery gulf, and believed the volcanic matter to be now exhausted: But on the 25th of April 1536, near a century from the slight eruption in 1447, a strong wind arose from the west, and a thick cloud, reddish in the middle, appeared over the summit of the mountain. At the very same instant a large body of fire issued from the abyss, and fell with the noise and rapidity of a torrent along the eastern side of the mountain, breaking down the rocks, and destroying the flocks and every other animal that was exposed to its fury. From the same crater, on the summit of the mountain, there issued at the same time a stream of fire more terrible than the other, and held its course towards the west. It ran over Bronte, Adrans, and Castelli. It consisted entirely of sulphur and bitumen. On the same day the church of St Leon, which stood in a wood, was first demolished by the shocks of the earthquake, and its ruins after that consumed by the fire. Many chasms were opened in the sides of the mountain; and from those issued fire and burning stones, which darted up into the air with a noise like that produced by a smart discharge of artillery. Francis Negro de Piazza, a celebrated physician, who lived at Lentini, wishing to have a nearer view of the eruptions, and to make some observations which he thought might be of consequence, was carried off and burnt to ashes by a volley

of the burning stones. This conflagration of Ætna lasted some weeks.

Ætna.

22. In less than a year, on the 17th of April 1537, the river Simeto swelled so amazingly as to overflow the adjacent plains, and carry off the country people and their cattle and other animals. At the same time, the country around Paterno, the neighbouring castles, and more than 500 houses, were destroyed by the ravages of the river; and most of the wood was torn up by the roots by violent blasts of wind. These ravages of the elements were followed by Ætna, which on the 11th of the following month was rent in several places, disclosing fiery gulfs, and pouring out a deluge of fire in more terrible torrents than those of the preceding year. They directed their course towards the monastery of St Nicholas d'Arena; destroyed the gardens and vineyards; and proceeding onwards towards Nicolosi, burnt Montpellieri and Fallica, and destroyed the vineyards and most of the inhabitants. When the conflagration ceased, the summit of the mountain sunk inward with such a noise, that all the people in the island believed the last day arrived, and prepared for their end by extreme unction. These dreadful disturbances continued through the whole year, more especially in the months of July and August, during which all Sicily was in mourning. The smoke, the noise, and the shocks of the earthquake, affected the whole island; and if Filotes may be believed, who relates this event, many of the Sicilians were struck deaf by the noise. Many structures were demolished; and among others the castle of Corleone, though more than 25 leagues distant from the volcano.

23. During the succeeding 30 years there was no disturbance of this nature. At the end of that space, Sicily was alarmed by a new eruption from the mountain. Ætna discharged new streams of fire, and covered the adjacent country with volcanic ashes, which entirely ruined the hopes of the husbandman.

24. In the year 1579, Ætna renewed its ravages; but no particular account of the damage which it did upon this occasion has been transmitted to us.

25. Twenty-five years had elapsed, when Ætna, in the month of June 1603, flamed with new fury. Peter Carrera affirms that it continued to emit flames for the space of 33 years, till 1636, without interruption, but not always with the same violence. In 1607, the streams of lava which flowed from it destroyed the woods and vineyards on the west side of the mountain. In 1609, they turned their course towards Aderno, and destroyed a part of the forest del Pino, and a part of the wood called *la Sciambrita*, with many vineyards in the district Costerna. These torrents of lava continued to flow for three months. In the year 1614, a new effort of the subterraneous fire opened another crater, from which fire was discharged on Randazzo, in the district called *il Piro*. The fire continued to flame for 10 or 12 years longer.

26. The same Peter Carrera relates, that a dreadful conflagration happened in the year 1664, of which he himself was witness. It happened on the 13th of December, and lasted without interruption, but with different degrees of violence, till the end of May 1678. But in 1669 the inhabitants of Nicolosi were obliged to

Ætna. to forsake their houses, which tumbled down soon after they left them. The crater on the summit of Ætna had not at this time a threatening aspect, and every thing there continued quiet till the 25th of March; but on the 8th of that month, an hour before night, the air was observed to become dark over the village la Pedara and all that neighbourhood; and the inhabitants of that country thought that an almost total eclipse was taking place. Soon after sunset, frequent shocks of earthquakes began to be felt; these were at first weak, but continued till day-break to become more and more terrible. Nicolosi was more affected than any other tract of country on that side of Ætna; about noon every house was thrown to the ground; and the inhabitants fled in consternation, invoking the protection of heaven. On the 10th of March a chasm several miles in length, and five or six feet wide, opened in the side of the mountain; from which about two hours before day, there arose a bright light, and a very strong sulphureous exhalation was diffused through the atmosphere.

About 11 in the forenoon of the same day, after dreadful shocks of earthquake, a crater was opened in the hill called *des Noisettes*, from which there issued huge volumes of smoke, not accompanied with fire, ashes, or stones, but with loud and frequent claps of thunder, displaying all the different phenomena with which thunder is at different times attended. And what was very remarkable, the chasm was formed on the south side, between the top and the bottom of the mountain. On the same day another chasm was formed two miles lower, from which issued a great deal of smoke, accompanied with a dreadful noise and earthquake. Towards the evening of the same day, four other chasms were opened towards the south, in the same direction, accompanied during their formation with the same phenomena, and extending all the way to the hill called *la Pusara*.

About twelve paces beyond that, another of the same kind was formed. On the succeeding night, a black smoke, involving a quantity of stones, issued from this last chasm; it discharged at the same time flakes of a dark earth-coloured spongy matter, which became hard after they fell. There issued from the same gulf a stream of lava, which held its course into a lake called *la Hardia*, six miles from Montpellieri, and on its way thither destroyed many dwelling houses and other buildings in the neighbouring villages.

On the next day, March 12th, this stream of fire directed its course towards the tract of country called *Malpasso*, which is inhabited by 800 people: in the space of 20 hours it was entirely depopulated and laid waste. The lava then took a new direction, in which it destroyed some other villages.

The mount of Montpellieri was next destroyed with all the inhabitants upon it.

On the 23d of the same month, the stream of fire was in some places two miles broad. It now attacked the large village of *Mazzalucia*; and on the same day a vast gulf was formed, from which were discharged sand or ashes, which produced a hill with two summits, two miles in circumference, and 150 paces high. It was observed to consist of yellow, white, black, gray, red, and green stones.

The new mount of Nicolosi continued to emit ashes

for the space of three months; and the quantity discharged was so great as to cover all the adjoining tract of country for the space of 15 miles; some of these ashes were conveyed by the winds as far as Messina and Calabria; and a north wind arising, covered all the southern country about Agosta, Lentini, and even beyond that, in the same manner.

While at that height on Nicolosi so many extraordinary appearances were passing, the highest crater on the summit of Ætna, still preserved its usual tranquillity.

On the 25th of March, about one in the morning, the whole mountain, even to the most elevated peak, was agitated by a most violent earthquake. The highest crater of Ætna, which was one of the loftiest parts of the mountain, then sunk into the volcanic focus; and in the place which it had occupied, there now appeared nothing but a wide gulf more than a mile in extent, from which there issued enormous masses of smoke, ashes, and stones. At that period, according to the historian of this event, the famous block of lava on Mount Frumento was discharged from the volcanic focus.

In a short time after, the torrent of fire, which still continued to flow, directed its course towards Catania with redoubled noise, and accompanied with a much greater quantity of ashes and burning stones than before. For several months many most alarming shocks of earthquakes were felt: and the city was threatened with destruction by the torrent of fire. In vain they attempted to turn or divert its course; the lava rose over the walls, and entered by an angle near the Benedictine convent on the 11th of June following. This awful event is related by Francis Monaco, Charles Mancius, Vincent Auria, and Thomas Thedeschi.

A description of the lava issuing from Mount Ætna in 1669 was sent to the court of England by Lord Winchelsea, who at that time happened to be at Catania in his way home from an embassy at Constantinople. Sir W. Hamilton gives the following extract of it. "When it was night, I went upon two towers in divers places; and I could plainly see, at ten miles distance, as we judged, the fire begin to run from the mountain in a direct line, the flame to ascend as high and as big as one of the greatest steeples in your Majesty's kingdoms, and to throw up great stones into the air; I could discern the river of fire to descend the mountain, of a terrible fiery or red colour, and stones of a paler red to swim thereon, and to be some as big as an ordinary table. We could see this fire to move in several other places, and all the country covered with fire, ascending with great flames in many places, smoking like a violent furnace of iron melted, making a noise with the great pieces that fell, especially those that fell into the sea. A cavalier of Malta, who lives there, and attended me, told me, that the river was as liquid, where it issues out of the mountain, as water, and came out like a torrent with great violence, and is five or six fathom deep, and as broad, and that no stones sink therein."

The account given in the Philosophical Transactions is to the same purpose. We are there told, that the lava is "nothing else than diverse kinds of metals and minerals, rendered liquid by the fierceness of the fire in the bowels of the earth, boiling up and gushing forth

Ætna. forth as the water doth at the head of some great river; and having run in a full body for a stone's cast or more, began to crust or curdle, becoming, when cold, those hard porous stones which the people call *sciarrz*. These, though cold in comparison of what first issues from the mountain, yet retained so much heat as to resemble huge cakes of sea-coal strongly ignited, and came tumbling over one another, bearing down or burning whatever was in their way.—In this manner the lava proceeded slowly on till it came to the sea, when a most extraordinary conflict ensued betwixt the two adverse elements. The noise was vastly more dreadful than the loudest thunder, being heard through the whole country to an immense distance; the water seemed to retire and diminish before the lava, while clouds of vapour darkened the sun. The whole fish on the coast were destroyed, the colour of the sea itself was changed, and the transparency of its waters lost for many months.

While this lava was issuing in such prodigious quantity, the merchants, whose account is recorded in the Philosophical Transactions, attempted to go up to the mouth itself; but durst not come nearer than a furlong, lest they should have been overwhelmed by a vast pillar of ashes, which to their apprehension exceeded twice the bigness of St Paul's steeple in London, and went up into the air to a far greater height; at the mouth itself was a continual noise, like the beating of great waves of the sea against rocks, or like distant thunder, which was sometimes so violent as to be heard 60, or even 100 miles off; to which distance also part of the ashes was carried. Some time after, having gone up, they found the mouth from whence this terrible deluge issued to be only a hole about 10 feet diameter. This is also confirmed by Mr Brydone; and is probably the same through which Sir William Hamilton descended into the subterranean caverns already mentioned.

27. Some years after this conflagration, a new burning gulf opened in the month of December 1682 on the summit of the mountain, and spread its lava over the hill of Mazarra.

28. On the 24th of May 1686, about ten in the evening, a new eruption burst out from the summit of the mountain on the side contiguous to the hill del Bue. Such a quantity of inflamed matter was thrown out as consumed woods, vineyards, and crops of grain, for four leagues round. It stopped its course in a large valley near the castle of Mascali. Several people from the neighbourhood had ascended a hill between the wood of Catania and the confines of Cirrita, to observe the progress of the lava: but the hill, on a sudden, sunk inwards, and they were buried alive.

29. *Ætna* was now long quiet; for no less a space of time indeed than one half of the present age. In the year 1755 its eruptions were renewed. It opened near Mount Lepira, and emitted as usual fire and smoke; after which it remained quiet only for eight years.

30. In the year 1763, there was an eruption which continued three months, but with intervals. *Ætna* was at first heard to rebel. Flames and clouds of smoke were seen to issue out, sometimes silver-coloured, and at other times, when the rays of the sun fell upon them, of a purple radiance: at length they were carried off by the winds, and rained, as they were

Ætna. driven before them, a shower of fire all the way to Catania and beyond it. An eruption soon burst out; the principal torrent divided into two branches, one of which ran towards the east, and fell into a deep and extensive valley.

The flames which issued from this new crater afforded a noble spectacle. A pyramid of fire was seen to rise to a prodigious height in the air, like a beautiful artificial fire-work, with a constant and formidable battery, which shook the earth under those who were spectators of the scene. Torrents of melted matter running down the sides of the mountain, diffused a light bright as day through the darkness of night.

At sunrising the burning lava was observed to have run round some oaks that were still standing unburnt. Their leaves were all withered. Some birds had fallen from their branches, and been burnt to death. Some people cast wood upon the lava, and it was immediately burnt. This lava continued hot, and exhaled smoke for two years. For five years after this, no snow appeared on the summit of *Ætna*.

31. In the year 1764 a new crater was opened at a great distance from Mount *Ætna*.

32. In the year 1766 another was opened at the grotto of Paterno: fire, smoke, and an inconsiderable torrent of lava issued out of it.

33. On the 27th of January 1780 a new opening was formed two miles under the last-mentioned crater. On the 28th of February, and the 14th March, the earthquake was renewed on the north side, and accompanied with terrible noises.

Between the 6th of April and the 7th of May the convulsions were again renewed, accompanied with noise as before; a quantity of pumice stones and fine sand was discharged from it.

On the 18th of May the shocks were renewed: on the 23d a new crater was formed on the side of Mount Frumento on the summit of *Ætna*; and from it a torrent of lava discharged, which spread through the valley of Laudunza. It was 200 paces in breadth. Two other chinks were opened in the mountain near Paterno, and very near one another. The lava issuing from them proceeded, in the space of seven days, six miles; on the 25th it had run nine miles.

A new crater was likewise opened on the 25th; from which a quantity of red-hot stones continued to issue for half an hour, and fell at a very great distance: there proceeded likewise from it a stream of lava; which, in the same space of time, ran over a tract of country two miles in extent.

Several parts of those streams of lava were observed to be cold on the surface, and formed into solid masses, but melted again by a new stream of burning lava, which however did not melt the old lava.

34. The last eruption happened in 1787. From the 1st Account of to the 10th of July, there were signs of its approach, the late On the 11th, after a little calm, there was a subterranean noise, like the sound of a drum in a close place, ^{1787.} and it was followed by a copious burst of black smoke. It was then calm till the 15th, when the same prognostics recurred. On the 17th, the subterraneous noise was heard again: the smoke was more abundant, slight shocks of an earthquake followed, and the lava flowed from behind one of the two little mountains which form

Ætna.

the double head of Ætna. On the 18th, while the spectators were in anxious expectation of a more severe eruption, all was quiet, and continued so more than 12 hours: soon after they perceived some new shocks, accompanied with much noise; and the mountain threw out a thick smoke, which, as the wind was westerly, soon darkened the eastern horizon: two hours afterwards a shower of fine black brilliant sand descended: on the east side it was a storm of stones; and, at the foot of the mountain, a deluge of flashes of fire, of scoria and lava.

These appearances continued the whole day; at the setting of the sun the scene changed. A number of conical flames rose from the volcano; one on the north, another on the south, were very conspicuous, and rose and fell alternately. At three in the morning, the mountain appeared cleft, and the summit seemed a burning mass. The cones of light which arose from the crater were of an immense extent, particularly the two just mentioned. The two heads seemed to be cut away: and at their separation was a cone of flame, seemingly composed of many lesser cones. The flame seemed of the height of the mountain placed on the mountain; so that it was probably two miles high, on a base of a mile and a half in diameter. This cone was still covered with a very thick smoke, in which there appeared very brilliant flashes of lightning, a phenomenon which Ætna had not before afforded. At times, sounds like those from the explosion of a large cannon were heard seemingly at a less distance than the mountain. From the cone, as from a fountain, a jet of many flaming volcanic matters was thrown, which were carried to the distance of six or seven miles: from the base of the cone a thick smoke arose, which, for a moment obscured some parts of the flame, at the time when the rivers of lava broke out. This beautiful appearance continued three quarters of an hour. It began the next night with more force; but continued only half an hour. In the intervals, however, Ætna continued to throw out flames, smoke, ignited stones, and showers of sand. From the 20th to the 22d, the appearances gradually ceased. The stream of lava was carried towards Bronte and the plain of Lago.

After the eruption, the top of the mountain on the western side was found covered with hardened lava, scoria, and stones. The travellers were annoyed by smoke, by showers of sand, mephitic vapours, and excessive heat. They saw that the lava which came from the western point divided into two branches, one of which was directed towards Libeccio; the other, as we have already said, towards the plain of Lago. The lava on the western head of the mountain, had from its various shapes been evidently in a state of fusion; from one of the spiracula, the odour was strongly that of liver of sulphur. The thermometer, in descending, was at 40 degrees of Fahrenheit's scale; while near the lava, in the plain of Lago, it was 140 degrees. The lava extended two miles; its width was from $13\frac{1}{4}$ to 21 feet, and its depth $13\frac{1}{4}$ feet.

These are the most remarkable circumstances we have been able to collect, that might serve to give an adequate idea of this famous mountain. Many things, however, concerning the extent, antiquity, &c. of the lavas, remain to be discussed, as well as the opinions of philosophers concerning the origin of the internal fire

which produces so much mischief: but the consideration of these belongs to the general article VOLCANO, to which the reader is referred.

ÆTNA salt, *Sal Ætnæ*, a name given by some authors to the sal ammoniac which is found on the surface and sides of the openings of Ætna, and other burning mountains, after their eruptions; and sometimes on the surface of the ferruginous matter which they throw out. This salt makes a very various appearance in many cases: it is sometimes found in large and thick cakes; sometimes only in form of a thin powder, scattered over the surface of the earth and stones. Some of this salt is yellow, some white, and some greenish.

ÆTOLARCHA, in Grecian antiquity, the principal magistrate or governor of the Ætolians.

ÆTOLIA, a country of ancient Greece, comprehending all that tract now called the *Despotat*, or *Little Greece*. It was parted on the east by the river Evanus, now the Fidari, from the Locrenses Ozolæ; on the west, from Acarnania, by the Achelous: on the north, it bordered on the country of the Dorians and part of Epirus; and, on the south, extended to the bay of Corinth.

The Ætolians were a restless and turbulent people; seldom at peace among themselves, and ever at war with their neighbours; utter strangers to all sense of friendship or principles of honour; ready to betray their friends upon the least prospect of reaping any advantage from their treachery: in short, they were looked upon by the other states of Greece no otherwise than as outlaws and public robbers. On the other hand, they were bold and enterprising in war; inured to labour and hardships; undaunted in the greatest dangers; jealous defenders of their liberties, for which they were, on all occasions, willing to venture their lives, and sacrifice all that was most dear to them. They distinguished themselves above all the other nations of Greece, in opposing the ambitious designs of the Macedonian princes; who, after having reduced most of the other states, were forced to grant them a peace upon very honourable terms. The constitution of the Ætolian republic was copied from that of the Achæans, and with a view to form, as it were, a counter alliance; for the Ætolians bore an irreconcilable hatred to the Achæans, and had conceived no small jealousy at the growing power of that state. The Cleomeneic war, and that of the allies, called the *social war*, were kindled by the Ætolians in the heart of Peloponnesus, with no other view but to humble their antagonists the Achæans. In the latter, they held out, with the assistance only of the Eleans and Lacedæmonians for the space of three years, against the united forces of Achaia and Macedon; but were obliged at last to purchase a peace, by yielding up to Philip all Acarnania. As they parted with this province much against their will, they watched all opportunities of wresting it again out of the Macedonian's hand; for which reason they entered into an alliance with Rome against him, and proved of great service to the Romans in their war with him; but growing insolent upon account of their services, they made war upon the Romans themselves. By that warlike nation they were overcome, and granted a peace on the following severe terms: 1. The majesty of the Roman people

Ætna
Ætolia

Ætolia. people shall be revered in all *Ætolia*. 2. *Ætolia* shall not suffer the armies of such as are at war with Rome to pass through her territories, and the enemies of Rome shall be likewise the enemies of *Ætolia*. 3. She shall, in the space of 100 days, put into the hands of the magistrates of *Corcyra* all the prisoners and deserters she has, whether of the Romans or their allies, except such as have been taken twice, or during her alliance with Rome. 4. The *Ætolians* shall pay down in ready money, to the Roman general in *Ætolia*, 200 *Euboic* talents, of the same value as the *Athenian* talents, and engage to pay 50 talents more within the six years following. 5. They shall put into the hands of the consul 40 such hostages as he shall choose; none of whom shall be under 12, or above 40 years of age: the prætor, the general of the horse, and such as have been already hostages at Rome, are excepted out of this number. 6. *Ætolia* shall renounce all pretensions to the cities and territories which the Romans have conquered, though these cities and territories had formerly belonged to the *Ætolians*. 7. The city of *Oenis*, and its district, shall be subject to the *Acar-nanians*.

After the conquest of *Macedon* by *Æmilius Paulus*, they were reduced to a much worse condition; for not only those among them who had openly declared for *Perseus*, but such as were only suspected to have favoured him in their hearts, were sent to Rome, in order to clear themselves before the senate. There they were detained, and never afterwards suffered to return into their native country. Five hundred and fifty of the chief men of the nation were barbarously assassinated by the partisans of Rome, for no other crime but that of being suspected to wish well to *Perseus*. The *Ætolians* appeared before *Æmilius Paulus* in mourning habits, and made loud complaints of such inhuman treatment; but could obtain no redress: nay, ten commissioners who had been sent by the senate to settle the affairs of Greece, enacted a decree, declaring that those who were killed had suffered justly, since it appeared to them that they had favoured the *Macedonian* party. From this time those only were raised to the chief honours and employments in the *Ætolian* republic who were known to prefer the interest of Rome to that of their country; and as these alone were countenanced at Rome, all the magistrates of *Ætolia* were the creatures and mere tools of the Roman senate. In this state of servile subjection they continued till the destruction of *Corinth*, and the dissolution of the *Achæan* league; when *Ætolia*, with the other free states of Greece, was reduced to a Roman province, commonly called the *province of Achaia*. Nevertheless, each state and city was governed by its own laws, under the superintendency of the prætor whom Rome sent annually into *Achaia*. The whole nation paid a certain tribute, and the rich were forbidden to possess lands anywhere but in their own country.

In this state, with little alteration, *Ætolia* continued under the emperors, till the reign of *Constantine the Great*, who, in his new partition of the provinces of the empire, divided the western parts of Greece from the rest, calling them *New Epirus*, and subjecting the whole country to the *præfectus prætorii* of *Illyricum*. Under the successors of *Constantine*, Greece was parcelled out into several principalities, especially after

the taking of *Constantinople* by the Western princes. At that time, *Theodorus Angelus*, a noble Grecian, of the imperial family, seized on *Ætolia* and *Epirus*. The former he left to *Michael* his son, who maintained it against *Michael Palæologus*, the first emperor of the Greeks, after the expulsion of the Latins. *Charles*, the last prince of this family, dying in 1430 without lawful issue, bequeathed *Ætolia* to his brother's son, named also *Charles*; and *Acar-nania* to his natural sons *Memnon*, *Turnus*, and *Hercules*. But, great disputes arising about this division, *Amurath II.* after the reduction of *Thessalonica*, laid hold of so favourable an opportunity, and drove them all out in 1432. The *Mahometans* were afterwards dispossessed of this country by the famous prince of *Epirus*, *George Castriot*, commonly called *Scanderbeg*; who, with a small army, opposed the whole power of the Ottoman empire, and defeated these barbarians in 22 pitched battles. That hero, at his death, left great part of *Ætolia* to the *Venetians*; but, they not being able to make head against such a mighty power, the whole country was soon reduced by *Mohammed II.* whose successors hold it to this day.

AFER, *DOMITIUS*, a famous orator, born at *Nismes*, flourished under *Tiberius*, and the three succeeding emperors. *Quintilian* makes frequent mention of him, and commends his pleadings. But he disgraced his talents, by turning informer against some of the most distinguished personages in Rome. *Quintilian*, in his youth, cultivated the friendship of *Domitius* very assiduously. He tells us that his pleadings abounded with pleasant stories, and that there were public collections of his witty sayings, some of which he quotes. He also mentions two books of his "*On Witnesses*." *Domitius* was once in great danger from an inscription he put upon a statue erected by him in honour of *Caligula*, wherein he declared that this prince was a second time consul at the age of 27. This he intended as an encomium, but *Caligula* taking it as a sarcasm upon his youth, and his infringement of the laws, raised a process against him, and pleaded himself in person. *Domitius*, instead of making a defence, repeated part of the emperor's speech with the highest marks of admiration; after which he fell upon his knees, and, begging pardon, declared, that he dreaded more the eloquence of *Caligula* than his imperial power. This piece of flattery succeeded so well, that the emperor not only pardoned, but also raised him to the consulship. *Afer* died in the reign of *Nero*, A. D. 59.

AFFA, a weight used on the Gold Coast of *Guinea*. It is equal to an ounce, and the half of it is called *eggeba*. Most of the blacks on the Gold Coast give these names to these weights.

AFFECTION, in a general sense, implies an attribute inseparable from its subject. Thus magnitude, figure, weight, &c. are affections of all bodies; and love, fear, hatred, &c. are affections of the mind.

AFFECTION, signifying a settled bent of mind towards a particular being or thing, occupies a middle space between *disposition* on the one hand, and *passion* on the other*. It is distinguishable from *Disposition*, which being a branch of one's nature, originally, must exist before there can be an opportunity to exert it upon any particular object; whereas *Affection* can never be ori-

Ætolia
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Affection.

* See *Dis-position*, and *Passion*.

Affection
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Affinity.

ginal, because, having a special relation to a particular object, it cannot exist till the object have once at least been presented. It is also distinguishable from Passion, which, depending on the real or ideal presence of its object, vanishes with it: whereas Affection is a lasting connection; and, like other connections, subsists even when we do not think of the person. A familiar example will illustrate this. There may be in one person's mind a disposition to gratitude, which, through want of an object, happens never to be exerted; and which therefore is never discovered even by the person himself. Another, who has the same disposition, meets with a kindly office that makes him grateful to his benefactor: An intimate connection is formed between them, termed *affection*; which, like other connections, has a permanent existence, though not always in view. The affection, for the most part, lies dormant, till an opportunity offer for exerting it: in that circumstance, it is converted into the passion of gratitude; and the opportunity is eagerly seized of testifying gratitude in the warmest manner.

AFFECTION, among physicians, signifies the same as disease. Thus the hysteric *affection* is the same with the hysteric disease.

AFFERERS or AFFERORS, in *Law*, persons appointed in courts-leet, courts-baron, &c. to settle, upon oath, the fines to be imposed upon those who have been guilty of faults arbitrarily punishable.

AFFETTUOSO, or *Con AFFETTO*, in the Italian music, intimates that the part to which it is added ought to be played in a tender moving way, and consequently rather slow than fast.

AFFIANCE, in *Law*, denotes the mutual plighting of troth between a man and woman to marry each other.

AFFIDAVIT, signifies an oath in writing, sworn before some person who is authorized to take the same.

AFFINITY, among civilians, implies a relation contracted by marriage; in contradistinction to consanguinity, or relation by blood.—Affinity does not found any real kinship; it is no more than a kind of fiction, introduced on account of the close relation between husband and wife. It is even said to cease when the cause of it ceases: hence a woman who is not capable of being a witness for her husband's brother during his lifetime, is allowed for a witness when a widow, by reason the affinity is dissolved. Yet with regard to the contracting marriage, affinity is not dissolved by death, though it be in every thing else.

There are several degrees of affinity, wherein marriage was prohibited by the law of Moses: thus, the son could not marry his mother, or his father's wife (Lev. xviii. 7. et seq.): the brother could not marry his sister, whether she were so by the father only or by the mother only, and much less if she was his sister both by the same father and mother: the grandfather could not marry his grand-daughter, either by his son or daughter. No one could marry the daughter of his father's wife, nor the sister of his father or mother; nor the uncle his niece; nor the aunt her nephew; nor the nephew the wife of his uncle by the father's side. The father-in-law could not marry his daughter-in-law; nor the brother the wife of his brother, while living; nor even after the death of his brother, if he left children. If he left not children, the surviv-

ing brother was to raise up children to his deceased brother, by marrying his widow. It was forbidden to marry the mother and the daughter at one time, or the daughter of the mother's son, or the daughter of her daughter, or two sisters together. It is true the patriarchs before the law married their sisters, as Abraham married Sarah, who was his father's daughter by another mother; and two sisters together, as Jacob married Rachel and Leah; and their own sisters by both father and mother, as Seth and Cain. But these cases are not to be proposed as examples: because in some they were authorized by necessity, in others by custom; and the law as yet was not in being. If some other examples may be found, either before or since the law, the Scripture expressly disapproves of them, as Reuben's incest with Bilhah his father's concubine, and the action of Amnon with his sister Tamar; and that of Herod-Antipas, who married Herodias his sister-in-law, his brother Philip's wife, while her husband was yet living.

AFFINITY is also used to denote conformity or agreement: Thus we say, the *affinity* of languages, the *affinity* of words, the *affinity* of sounds, &c.

AFFINITY, in *Chemistry*, is a term employed to express that peculiar propensity which the particles of matter have to unite and combine with each other exclusively, or in preference to any other connection.

The attractions between bodies at insensible distances, and which of course are confined to the particles of matter, have been distinguished by the name of *affinity*, while the term *attraction* has been more commonly confined to cases of sensible distance. And as the particles of matter are of two kinds, either *homogeneous* or *heterogeneous*, so there are two kinds of affinity.

"Homogeneous affinity urges the homogeneous particles towards each other, and keeps them at insensible distances from each other; and consequently is the cause why bodies almost always exist united together, so as to constitute masses of sensible magnitude. This affinity is usually denoted by the term *cohesion*, and sometimes by *adhesion* when the surfaces of bodies are only referred to. Homogeneous affinity is nearly universal; as far as is known, caloric and light only are destitute of it.

"Heterogeneous affinity urges heterogeneous particles towards each other, and keeps them at insensible distances from each other, and of course is the cause of the formation of new integrant particles composed of a certain number of heterogeneous particles. These new integrant particles afterwards unite by cohesion, and form masses of compound bodies. Thus an integrant particle of water is composed of particles of hydrogen and oxygen, urged towards each other, and kept at an insensible distance by heterogeneous affinity; and a mass of water is composed of an indefinite number of integrant particles of that fluid, urged towards each other by homogeneous affinity. Heterogeneous affinity is universal, as far as is known; that is to say, there is no body whose particles are not attracted by the particles of some other body; but whether the particles of all bodies have an affinity for the particles of all other bodies, is a point which we have no means of ascertaining. It is, however, exceedingly probable, and has been generally taken for granted; though it

Affinity.

is certainly assuming more than even analogy can warrant." (*Thomson's Chemistry*.)
AFFIRMATION, in *Logic*, the asserting the truth of any proposition.

AFFIRMATION, in *Law*, denotes an indulgence allowed to the people called *Quakers*: who, in cases where an oath is required from others, may make a solemn affirmation that what they say is true; and if they make a false affirmation, they are subject to the penalties of perjury. But this relates only to oaths taken to the government, and on civil occasions; for *Quakers* are not permitted to give their testimony in any criminal case, &c.

AFFIRMATION is also used for the ratifying or confirming the sentence or decree of some inferior court: Thus we say, the house of lords affirmed the decree of the chancellor, or the decree of the lords of session.

AFFIRMATIVE, in *Grammar*. Authors distinguish affirmative particles; such as, *yes*.—The term *affirmative* is sometimes also used substantively. Thus we say, the affirmative is the more probable side of the question: there were so many votes, or voices, for the affirmative.

AFFIX, in *Grammar*, a particle added at the close of a word, either to diversify its form or alter its signification. We meet with *affixes* in the Saxon, the German, and other northern languages; but more especially in the Hebrew, and other oriental tongues. The Hebrew *affixes* are single syllables, frequently single letters, subjoined to nouns and verbs; and contribute not a little to the brevity of that language. The oriental languages are much the same as to the *radicals*, and differ chiefly from each other as to *affixes* and *prefixes*.

AFFLATUS, literally denotes a blast of wind, breath, or vapour, striking with force against another body. The word is Latin, formed from *ad*, "to," and *flare*, "to blow." Naturalists sometimes speak of the afflatus of serpents. Tully uses the word figuratively, for a divine inspiration; in which sense, he ascribes all great and eminent accomplishments to a divine afflatus. The Pythian priestess being placed on a tripod or perforated stool, over a holy cave, received the divine afflatus, as a late author expresses it, in her belly; and being thus inspired, fell into agitations, like a phrenetic; during which she pronounced, in hollow groans and broken sentences, the will of the deity. This afflatus is supposed, by some, to have been a subterraneous fume, or exhalation, wherewith the priestess was literally inspired. Accordingly, it had the effects of a real physical disease; the paroxysm of which was so vehement, that Plutarch observes it sometimes proved mortal. Van Dale supposes the pretended enthusiasm of the Pythia to have arisen from the fumes of aromatics.

AFFLICTION is not itself, in propriety of medical speech, a disease, but it is the cause of many: for whatever excites envy, anger, or hatred, produces diseases from tense fibres; as whatever excites fear, grief, joy, or delight, begets diseases from relaxation.

AFFORAGE, in the French customs, a duty paid to the lord of a district, for permission to sell wine, or other liquors, within his seignior. Afforage is also used for the rate or price of provisions laid and fixed by the provost or sheriffs of Paris.

AFFORESTING, **AFFORESTATIO**, the turning ground into forest. The Conqueror, and his successors,

continued afforesting the lands of the subject for many reigns; till the grievance became so notorious, that the people of all degrees and denominations were brought to sue for relief; which was at length obtained, and commissions were granted to survey and perambulate the forest, and separate all the new afforested lands, and reconvert them to the uses of their proprietors, under the name and quality of *purlieu* or *pouralle land*.

AFFRAY, or **AFFRAYMENT**, in *Law*, formerly signified the crime of affrighting other persons, by appearing in unusual armour, brandishing a weapon, &c.; but at present, *affray* denotes a skirmish or fight between two or more.

AFFRONTÉE, in *Heraldry*, an appellation given to animals facing one another on an escutcheon; a kind of bearing which is otherwise called *confrontée*, and stands opposed to *adossee*.

AFFUSION, the act of pouring some fluid substance on another body. Dr Grew gives several experiments of the linctation arising from the affusion of divers menstruums on all sorts of bodies. Divines and church historians speak of baptism by affusion; which amounts to much the same with what we now call *sprinkling*.

AFGHANS, in *History*, a people who inhabit a province in the northern parts of India, between the 30th and 35th degrees of latitude. Its length from north to south may be estimated at 350 miles, and its breadth at 300. Cabul and Candahar are the two principal divisions of the country; but many of the contiguous provinces have also been occasionally subject to their princes. It is probable that not one-fiftieth part of the country is under a state of permanent cultivation. Most of the genuine Afghan tribes are migratory, and dwell in tents, and subsist on the produce of their flocks. In the south, the country of the Afghans is a barren desert of sand: to the north of Cabul it is a savage and mountainous region. The central part, through which the rivers Cow and Cabul flow, is fertile. The population probably does not exceed three millions of all descriptions. The armies of the state are composed of a diversity of nations; but the best troops are drawn from the Afghan districts. Cavalry constitute their chief military strength; a serviceable horse in this country costing only about six pounds sterling. A corps of infantry, armed with matchlocks, composes also a part of the Afghan armies.

The Afghans have been sometimes described as Tartars; but they bear no resemblance to this people, either in person or language. They are hardy and robust; and being addicted to a state of predatory warfare, have a fixed contempt for the occupations of civil life. Bread, of wheat and barley, milk, butter, and cheese, compose their usual diet. Throughout Hindostan they are represented as ferocious, sanguinary, and treacherous; but their courage and military habits make them be sought after as soldiers by the native powers.

They boast of being descended of Saul the first king of Israel, and that their great ancestor was raised from the rank of a shepherd, not on account of his princely qualities, but because his stature was exactly equal to the length of a rod which the angel Gabriel had given to the prophet Samuel as the measure of the stature of him whom God had destined to fill the throne of Israel.

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The province which they occupy at present was formerly called Roh; and hence is derived the name of the Rohillas. The sects of the Afghans are very numerous, and they are Mussulmans, partly of the Sunni, and partly of the Schiek persuasion. They are divided into four classes. The first is the *pure* class, consisting of those whose fathers and mothers were Afghans. The second class consists of those whose fathers were Afghans and mothers of another nation. The third class contains those whose mothers were Afghans and fathers of another nation. The fourth class is composed of the children of women whose mothers were Afghans and fathers and husbands of a different nation. Persons who do not belong to one of these classes are not called Afghans.

Sir William Jones seems to have had no doubt but the Afghans are descendants of Israel. "We learn (says he) from Esdras, that the ten tribes, after a wandering journey, came to a country called Arsareth, where we

may suppose they settled: now the Afghans are said by the best Persian historians to be descended from the Jews. They have traditions among themselves of such a descent; and it is even asserted, that their families are distinguished by the names of Jewish tribes, although since their conversion to Islam, they studiously conceal their origin from all whom they admit not to their secrets. The Pushto language, of which I have seen a dictionary, has a manifest resemblance to the Chaldaic; and a considerable district under their dominion is called Hazareth or Hazaret, which might easily have been changed into the word used by Esdras. (*Asiatic Researches*.)

AFRANIUS, LUCIUS, a Latin comic poet, who lived about a century before Christ. He wrote comedies in imitation of Menander; and is commended by Tully and Quintilian for his acute genius and fluent style. Some fragments of his works only are now extant.

A F R I C A.

Africa.

AFRICA, (derived according to Bochart from a Punic word signifying *ears of corn*), was represented by the ancients as one of the three great divisions or continents of which they believed the world to consist.—By them it was called *Libya*. Since the discovery of America, it has been considered by the moderns as one of the four quarters of the globe.

Excepting at its north-east corner, called the *Isthmus of Suez*, which is a neck of land, about sixty miles over, that unites it to Asia, Africa is entirely surrounded by water. On the north it is bounded by the Mediterranean sea, which divides it from Europe. Its whole western coast is washed by the waters of the Atlantic ocean, by which it is divided from America; and on the east, the Red sea and the Indian ocean separate it from Asia. From the Mediterranean sea on the north, to the Cape of Good Hope, which constitutes its southern extremity, is no less than 4300 miles. Its broadest part, from Cape Verd, in the Atlantic ocean, to Cape Guarda-fui, near the straits of Babel-Mandel, at the mouth of the Red sea, is 3500 miles from west to east. In shape it somewhat resembles a triangle, of which the Mediterranean sea and the Atlantic ocean form two sides, while the third side consists of the Red sea and the Indian ocean.

Africa little known.

The greater part of this vast peninsula has in all ages remained unknown to the other inhabitants of the world. The general aspect however of its situation, represents it as well situated for maintaining a commercial intercourse with the other quarters of the globe. It stands as it were in the centre between Europe, Asia, and America; and therefore has a much nearer communication with each of them than they can have with one another. It is opposite to Europe, on its northern boundary, the Mediterranean sea, for almost 1000 miles in a line from east to west; the distance seldom 100 miles, never 100 leagues. It is opposite to Asia the whole length of the Red sea; the distance sometimes only 15 miles, seldom 50 leagues. Its coast, for about 2000 miles, lies opposite to America, at the distance of from 500 to 700 leagues, in-

cluding the islands; whereas America is nowhere nearer Europe than 1000 leagues, and excepting at its north-west corner, where it is yet little known, is not nearer to Asia than 2500 leagues.

The knowledge of the ancients concerning Africa seems to have been, in a great degree, limited to the countries adjoining to the Mediterranean or to the Red sea. The ideas, however, which Herodotus entertained of this great continent are by no means incorrect upon the whole: and it has been reserved for our own times to verify a part of the description which he has given of the interior of Africa. Previous to his time, the whole sea coast of this continent had been explored by the conductors of an expedition fitted out by Necho, one of the kings of Egypt. It is to be observed that this Necho took Sidon, and reduced Phœnicia and Palestine. He must therefore have possessed considerable maritime power: Nor was he less powerful by land; for he marched through Palestine and Syria to attack the Assyrians near the Euphrates, and, in his way, defeated and slew Josiah the king of Judah, who opposed his march at Megiddo (2 Kings xxiii. 29.) Having defeated the Assyrians (or Babylonians) he placed a strong garrison in Carchemish, a fortified city on the Euphrates which he had taken; and, in his return, he took possession of Jerusalem, called Cadytis by Herodotus. This enterprising prince employed a body of Phœnician mariners to circumnavigate Africa, an undertaking which they accomplished with success. The following is the short narrative given by Herodotus of this remarkable transaction: "Except in that particular part which is contiguous to Asia, the whole of Africa is surrounded by the sea. The first person who has proved this, was, as far as we are able to judge, Necho king of Egypt. When he had desisted from his attempt to join by a canal the Nile with the Arabian gulf, he dispatched some vessels, under the conduct of Phœnicians, with directions to pass by the Columns of Hercules, and, after penetrating the Northern ocean, to return to Egypt. These Phœnicians, taking their course from the Red sea, entered into

Africa

Expedition of Necho king of Egypt against Phœnicia

Circumnavigation of Africa

Herodotus account of it



CENTRAL
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Africa.

into the Southern ocean. On the approach of autumn they landed at Libya, and planted some corn in the place where they happened to find themselves: when this was ripe, and they had cut it down, they again departed. Having thus consumed two years, in the third they passed the Columns of Hercules, and returned to Egypt. The relation may obtain attention from others, but to me it seems incredible; for they affirmed that, having sailed round Africa, *they had the sun on their right hand*. Thus was Africa for the first time known."

Many of the most eminent of the ancient historians and geographers regarded this account of the circumnavigation of Africa as altogether fabulous, chiefly in consequence of the story concerning the appearance assumed by the great celestial bodies in the course of the voyage, which was then unintelligible, from the imperfect state of the science of astronomy. But the very circumstances which, among the ancients, excited a doubt about the existence or success of such a voyage, must now be regarded as affording the most satisfactory internal evidence of the veracity of the ancient Phœnician navigators.

The Carthaginians were the rivals of the Egyptians in commerce, and must undoubtedly have explored a great part of the coast of Africa; but, according to the usual cautious and monopolizing spirit of commercial states, it is probable that they concealed their discoveries from other nations. As almost no monuments of their literature now exist, we are deprived of the means of investigating the full extent of their geographical knowledge. One important document has, however, reached our times, which demonstrates the enterprising spirit of that people. This is, an apparently abridged journal of a voyage to the western coast of Africa, undertaken by Hanno the Carthaginian, about 30 or 40 years after the expedition above mentioned under Necho king of Egypt. Herodotus does not seem to have been informed of this undertaking of Hanno; nor does Pliny appear to have seen the journal of the voyage, though he is no stranger to its contents.

Hanno is said to have deposited, at his return, the journal of his voyage in the temple of Saturn; which may perhaps account for the means of its preservation. It begins by stating, that "it was decreed by the Carthaginians that Hanno should undertake a voyage beyond the Pillars of Hercules, and found Libyphœnician cities. He sailed, accordingly, with 60 ships of 50 oars each, and a body of men and women to the number of 30,000, and provisions and other necessaries." From the extent of this plan of colonization, or rather of establishing permanent garrisons, upon the western coasts of Africa, it is evident that these coasts must, in some measure, have been previously examined. Major Rennel, who has investigated the subject with great accuracy, with a reference to the journal of the voyage, is of opinion that the Carthaginian or Libyphœnician cities founded by Hanno, were all situated to the south of the strait of Gibraltar, and to the northward of the river Senegal; and that all of them, excepting one at Cernè, now called Arguin, were placed to the north of Cape Bodajor. To the southward of Cernè, Hanno during his voyage made two expeditions; but it does not appear that he made any attempt to fix an establishment beyond the limits now mentioned. On his first expedition, he seems to have sailed into the river Sene-

gal, as may be supposed from the description given; for it is said to be "large and broad, and full of crocodiles and river horses." During the same voyage, Hanno made a second expedition southward, apparently for the sake of discovery. He appears to have doubled Cape Verd, and to have sailed across the mouth of the Gambia. His voyage is said to have terminated at a place which he calls the Southern Horn, supposed to be either at Sierra Leona, or, at a little distance to the south of it, at Sherbro. It is evident, from the general style of the journal, that the Carthaginians, at the time of this voyage, were altogether unacquainted with the interior state of the country on the western quarter of Africa. Excepting the mere description of the coast, and its windings and bays, every thing is marvellous, and apparently fabulous. They talk of having caught two women covered with hair, whose skins they brought to Carthage, meaning, in all probability, two monkeys of some of the unknown species which abound in the country of the Negroes. They also talk of streams of fire, and of rivers of fire which seemed to be running into the sea. At one place, during the night, they saw a country which was on fire: and afterwards they saw another country full of fires; in the middle of which was a lofty fire, larger than the others, which seemed to touch the stars. When day came, they discovered this elevated fire to be a large hill, which they called *the chariot of the gods*. These wonders have been explained to us by later travellers; who remark that it is the custom, at certain seasons of the year, in the country of the Negroes, to set fire to the dry grass; and that on those occasions, during the night, the whole territory seems to be a sheet of flame.

With regard to Africa in general, Herodotus describes it in this summary way: "All that part of Libya towards the northern sea (Mediterranean), from Egypt to the promontory of Soloeis (now Cape Cantin on the coast of Morocco) which terminates the third division of the earth, is inhabited by the different nations of the Libyans; that district alone excepted in possession of the Greeks and Phœnicians. The remoter parts of Libya beyond the sea coast, and the people who inhabit its borders, are infested by various beasts of prey.—The country *yet more distant* is a parched and *immeasurable desert*." Here this ancient historian clearly distinguishes three belts or regions parallel to the Mediterranean, the northernmost of which we must conceive to have been that which extended along the sea coast, and was bounded on the south by Mount Atlas, and other ridges. The middle one is now called the Country of Dates, because the inhabitants chiefly live on that fruit; and the third is the great African desert. Beyond these, however, Herodotus had heard of a fourth region, belonging to the negroes; for, in another place he divides the inhabitants of Africa generally into two races (with the exception of strangers, viz. the Phœnicians and the Greeks). The natives (says he) are the Africans and Ethiopians, one of which possesses the northern, and the other the southern part of Africa."—By these nations are evidently intended the Moors and the Negroes, which two classes are as distinct at the present day as they were in ancient times.

This author, whose account of the ancient nations will always be a matter of much curiosity, because he has justly been called *the Father of History*, as being the

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Africa.

the earliest authentic historian whose writings have been transmitted to us, gives a detailed account of the tribes that in his time inhabited the northern coast of Africa, upon the borders of the Mediterranean; beginning with Egypt and proceeding westward to the lesser Syrtis, mentioning only in general terms, the rest of the country to the promontory of Soleis, (Cape Cantin), which was erroneously regarded by him as the most westerly point of the coast of Africa. The people of this coast he represents generally as Nomades, from Egypt westward to the lake Tritonis, by which he means the lesser Syrtis, or gulf of Kabes; and the country, he says justly, is low and sandy. The country farther to the west, called *Africa Proper*, or *Numidia*, by the Romans, including the present states of Morocco, Algiers, and Tunis, he describes as mountainous and interspersed with wood, and infested by wild beasts and serpents of an enormous size. Within this tract, however, he represents the inhabitants as husbandmen who cultivate the ground and live in houses. Mount Atlas is mentioned by him in the same magnificent terms in which all the ancient writers speak of it. "At every approach it appears round and steep, and so lofty that its summit can never be distinguished by reason of the clouds that envelope it."

Egypt was, in the days of Herodotus, a rich and populous state, from which the Greeks had derived a great part of their arts and of their religion. Beginning from Egypt and proceeding westward, he enumerates the Africans in the following manner. The first are the *Adyrmachiæ*, whose manners were in every respect Egyptian, that is to say, civilized. He imputes to them, however, a barbarous custom, that their king possessed the privilege of sleeping the first night with every new married woman. They inhabited the coast between Egypt and the port of Pleunos, adjoining to what is now called the *desert of Barca*. Next to the *Adyrmachiæ* were the *Gilligamæ*, who occupied the coast as far as the island of Aphrodisias, supposed to be near Derna. The *Asbystæ* were a small inland tribe, situated between the *Gilligamæ* on the east, and the *Auschicæ* on the west, having no communication with the sea. They were accounted remarkable beyond all the Africans for the use of chariots drawn by four horses; and, it is to be observed, that Herodotus says the Greeks borrowed from Africa the custom of harnessing four horses to a chariot. The *Auschicæ*, who bordered on the west of the *Asbystæ*, extended from above Barca to the neighbourhood of the *Hesperides* on the sea coast. The *Cabales*, an inconsiderable tribe, occupied the coast opposite to the centre of the *Auschicæ*, and extended themselves along the coast near Tauchira, a town belonging to Barca.

The province of Cyrenaica, (now Kairoan or Kurin), was situated within the tract of the Nomades. It was the most elevated part of it, and wonderfully fertile. It contained the first Grecian colony, and was also named *Libya Pentapolis*, from its having five towns of note in it, Cyrene, Barce, Ptolemais, Berenice, and Tauchira; all of which not only still exist as towns or villages, but it is remarkable that their names are scarcely altered, being called *Kurin*, *Barca*, *Tollamata*, *Bernicæ*, and *Taukera*. The celebrated gardens of the *Hesperides* were situated upon this coast on the western border of the desert of Barca.

The *Nasamones*, according to Herodotus, were the most powerful of the Nomadic tribes upon this coast. They bordered upon the greater Syrtis, now called the *gulf of Sort*. He says, that during the summer season they leave their cattle on the coast, and go up into the country to gather dates at a place called *Augela*, which will be afterwards noticed. The *Nasamones* are said to have seized upon the territories of the *Psylli*. These were a people who possessed the reputation of being able to charm serpents, and to cure the wounds occasioned by their stings. Cato is said by Plutarch to have carried some of the *Psylli* with him for that purpose, in his memorable march round the greater Syrtis. It is certain, that in modern times, in Egypt, Abyssinia, and India, certain persons are believed to possess the power of completely subduing serpents of the most venomous kinds, so as to have them entirely under their command. They are said to seize on them with their naked hands, without apprehension of mischief, and this not only on serpents they have already been accustomed to, but on such as they never saw before.

Beyond the *Nasamones* to the southward, Herodotus mentions the *Garamantes*, whom he represents as a numerous nation, situated ten journeys from *Augela*, between the *Nasamones* and the *Macæ*. The *Macæ* appear to have been the next tribe upon the coast after the *Nasamones*. The present towns of Mesurata and Lebida are situated within the territory that belonged to them. The *Gindanes*, *Lotophagi*, and *Machlycs*, in the order here mentioned, occupied the remainder of the space between the *Macæ* and the lake Tritonis, or gulf of Kabes; for Herodotus appears to have understood by the lake Tritonis, either the gulf alone, or the gulf and an adjoining lake collectively, which in his time very probably had a communication, though they are now separated by a neck of land, and the lake receives the name of *Lowdeah*. It is to be observed, that the *Lotophagi* derived their name from the fruit of a tree or shrub called the *lotus*, upon which they subsisted, supposed to be the *rhannus lotus* of Linnæus. It is not only found in this territory, but also upon the whole northern coast of Africa, and on many spots of the desert, and even in the country of the Negroes. To the westward of the lake Tritonis, Herodotus mentions the *Auses*, the *Maryes*, the *Zaveces*, and the *Zygantes*; which last appear to have been the inhabitants of the province that contained the city of Carthage: of the territories of this last state Herodotus gives no description, though he says, that he is able to name all the nations that inhabit the country as far as the *Atlantes*, beyond which he knows nothing. Some other positions in the north of Africa that were known in the times of Herodotus, will be afterwards mentioned.

With regard to the interior of Africa, the knowledge of Herodotus was very indistinct. He mentions Ethiopia in a way that in some measure corresponds with Nubia, and Abyssinia: "Ethiopia, (says he); which is the extremity of the habitable world, is contiguous to Arabia on the south-west. It produces gold in great quantities, elephants with their prodigious teeth, trees and shrubs of every kind, as well as ebony. Its inhabitants are also remarkable for their size, their beauty, and their length of life." To Ethiopia, however, he gives a wide extent, so as to include

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Inhabitants
of Africa
according
to Herodo-
tus.

clude the whole region inhabited by men of a black complexion, as he calls it, the "extremity of the habitable world." The remotest source of the Nile was unknown in his days; and after all the efforts that have been made for its discovery, it may be regarded as having hitherto been visited by no European. He supposes, however, that the course of the Nile, "without reckoning that part of it which flows through Egypt, was known to the extent of four months journey, partly by land, partly by water;" but beyond this its course was unknown, though he says "it is certain that the Nile rises in the west." The most remarkable fact, however, mentioned by Herodotus concerning the investigation of the interior of Africa, consists of the adventures of certain *Nasamones* who came from the neighbourhood of Cyrene, now called *Kurin*. He says that they made an expedition into the interior of Africa, with a view to extend their discoveries beyond all preceding adventurers. No attempt is made to state the distance to which they penetrated; but it must have been very great: "first proceeding through the region which was inhabited, they next came to that which was infested by wild beasts; leaving which, they directed their course westward through the desert, and were finally taken prisoners by black men of a diminutive stature, and carried to a city washed by a great river, which flowed from west to east, and abounded in erocodiles." Of this great river nothing farther was ever discovered by the ancients. Herodotus thought that it was probably the Nile, and Pliny calls it the river Niger, or the river of the blacks or Ethiopians.

The Romans were not a commercial people, and troubled themselves little about the discoveries of the Egyptians and Carthaginians whom they vanquished. The fertile districts, however, in the north of Africa adjoining to the shore of the Mediterranean, formed the chief granary of the empire during its most prosperous period. Beyond these districts they pushed their conquests only so far as was necessary to secure their possessions against the barbarians of the desert. Both Augustus and Nero, however, sent persons to attempt to discover the source of the Nile, but without success; and the Romans were never remarkable for investigating the state of foreign countries when they had no scheme of conquest in view. In the decline of the Roman empire A. D. 426. Bonifacius, the governor of Africa, revolted, and called in the aid of Genseric the chief of a horde of barbarians called *Vandals*, who had penetrated from the north of Europe into Spain. These barbarians crossed the straits of Gibraltar, and soon became masters of the country. About a century thereafter, their descendents, in a fertile and enervating climate, having lost their military character, were vanquished by the celebrated Belisarius under Justinian, then at the head of the eastern division of the Roman empire. At a later period, when Mahomet had roused his countryman to war and conquest, under the influence of a furious fanaticism, Egypt and the rest of the north of Africa were overrun by the Arabs, or, as they are called, the *Saracens*, A. D. 647. In a few centuries thereafter, the empire of the Saracens in Africa, where they were called *Moors*, was gradually divided into a variety of petty states called

the *States of Barbary*, which acknowledged rather a nominal than a real dependence upon the Turkish empire.

The rest of Africa was forgotten till the fifteenth century, when the discovery of the mariners compass enabled the Europeans to extend their maritime enterprises to all the quarters of the globe, with a facility that was formerly unknown. In these enterprises the Portuguese took the lead. They had never sailed along the western coast of Africa, beyond Cape Non, in 27° north latitude, till A. D. 1412, when they ventured 160 miles farther, to Cape Bojador, whose rocky cliffs stretching out to a considerable distance into the Atlantic ocean, intimidated them from advancing farther. In 1419, when attempting to double this cape, they discovered the Madeira isles. Afterwards in 1433, they passed Cape Bojador, penetrated between the tropics, and discovered the river Senegal and the Cape de Verd isles situated between 14° and 18° north latitude. In 1471, they crossed the equator, and were astonished to find that the torrid zone contained fertile and populous regions, instead of being burnt up by perpetual heat as had been formerly believed. In 1484, the Portuguese navigators, now become ambitious of the reputation of discoverers of new countries, penetrated 1500 miles beyond the equator; and two years thereafter Bartholomew de Diaz discovered the Cape of Good Hope. In 1497, this cape, being the southern extremity of Africa, was passed by Vaquez de Gama.

At this time the European nations were fast emerging from barbarism. The feudal aristocracies, by which they had been kept in a state of perpetual anarchy, were gradually subdued by different princes, and a few powerful states or monarchies were raised upon their ruins. These states enjoying greater domestic tranquillity, were become capable of directing the energy and superior intelligence, which began to prevail in the European character, to enterprises requiring united and successive efforts. The discoveries of the Portuguese, by pointing out a very fertile region in the centre of Africa, in which gold and ivory could be obtained in exchange for the manufactures of Europe, and in which settlements could be easily formed, would in all probability have directed to this quarter the whole activity of the most enterprising of the European states, had not other events diverted them to different quarters. The events now alluded to, where the discovery of America by Columbus in 1492, and the easy communication with the East Indies, opened up by the discovery of the passage round the Cape of Good Hope. Hence it has happened, that during these three centuries Africa has been much neglected; and, in the most enterprising period of the history of the world, the European nations, though the most enterprising of mankind, have left in a great measure unexplored this immense continent, though situated in their vicinity, and abounding in valuable productions. A few factories for the purpose of procuring slaves have been established by the English, French, and Spaniards, upon the western coast, to the north of the equator. From thence to the tropic of Capricorn, the Portuguese have a few settlements, upon the east and the west coast, for the same purpose; and the Dutch settlement at the Cape of Good Hope,

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Hope, is the only establishment at all worthy of the name of an European colony, retaining the language and somewhat of the manners of the parent state.

African Association.

What is known of the interior of Africa is chiefly the result of the efforts of particular travellers, who have penetrated into different quarters of that great continent, impelled by the ambition of extending the limits of human knowledge; or it is the fruit of the exertions of a private society of persons of rank in England, instituted in 1788, bearing the name of the *African Association*, who have employed at their expence, various individuals to enter Africa at different points, and to proceed by such routes as have been thought most likely to lead to important discoveries.

We shall now give a concise account of the great continent of Africa, as far as a knowledge of it has been obtained from these different sources. In the statement now to be given, however, we shall avoid taking any farther notice of that fertile stripe of territory on the north of Africa, which borders upon the Mediterranean sea, or upon the Atlantic ocean, southward to the mountains of Atlas, constituting the states of Egypt, Tripoli, Tunis, Algiers, Fez, and Morocco. Neither shall we take any notice of the country of Abyssinia at the head of the Nile, or of the Dutch settlement of the Cape of Good Hope, as each of these will be separately discussed under their proper names.

Divisions of Africa.

Africa, to the south of the states on the Mediterranean and of Morocco, consists of two great divisions, the *Sahara*, or great desert, which is the country of the Moors or Arabs; and *Nigritia*, *Negroland*, or the country of the negroes or *Æthiopians*. The limits of these two divisions, though not in all cases accurately defined, depend on the soil and climate, and appear to have remained permanent from the days of Herodotus.

Sahara, or the great desert.

The Sahara, or great desert, extends from the south of Morocco, and of the states on the Mediterranean, commonly called the Barbary States, to the rivers Senegal and Niger, or to a line drawn across the continent of Africa, from Cape Verd to the Red sea. Beyond the Sahara or desert, to the southward, is the country of the Negroes.

The Sahara presents a surface equal in extent to nearly one half of Europe. It is upwards of 800 miles in breadth from north to south, and more than double that extent in length, from the Atlantic ocean on the west, to the frontiers of Abyssinia on the east. Its general description is that of a vast wilderness of lifeless sand, parched by the intolerable heat of an almost vertical sun. Its chief varieties consist of immense plains covered with naked pebbles, or of barren rocks towering towards an unclouded and burning sky. The sterility of the soil is rather marked than alleviated by some scattered plants, and by the verdure of a few valleys in which water either stagnates or springs up.

The general description, however, of the great African wilderness, is by no means to be understood as universal or without exception. The desert is here and there interspersed with spots of astonishing fertility, which are crowded with inhabitants. Every thing in the climate of Africa is in extremes. No cold is indeed experienced in that vast continent; but barrenness and fertility of soil border upon each other with a degree of suddenness, of which, in the temperate cli-

mates of Europe, we have no conception. The traveller passes in an instant from burning sands to a rich landscape, in which flocks and herds, and towns and villages abound. The same vicinity of a tropical sun which renders the wilderness intolerable, rears up all vegetable productions in the utmost luxuriance and perfection, in every spot in which water and a tolerable depth of soil are to be found. These sequestered situations in this great desert were called *Oases*, or *Islands*, by the ancients. Under the Roman empire it was not unusual to banish state criminals to an island in the great Libyan desert. The continent of Africa, like that of South America, is highest on its western side, and its greater rivers the Senegal, the Gambia, and the Niger, rise in a chain of mountains situated nearer to the Atlantic than the Indian ocean. As the Sahara extends towards the east and also towards the shores of the Mediterranean on the north, its islands abound most in these regions. But the lesser islands are not always permanent. A furious wind from the desert, bringing along with it an immense quantity of sand, sometimes overwhelms a whole fertile district, and reduces it to barrenness. We shall here take notice, however, of such of the sequestered islands of this desert as are now known to be most important.

The ancients mention very particularly under the name of Oasis three situations, called the *Greater Oasis*, the *Lesser Oasis*, and the *Oasis of Ammon*. Of these the *Greater Oasis* is at present the best known to the Egyptians and the Arabs, because the caravans from Cairo to Darfur pass along it. It is named *Al Wah*, or the *Oasis*, by way of excellence. It appears to consist of a number of detached fertile spots or islands, extending in a line parallel to the course of the Nile, and of the mountains that border the valley of Upper Egypt. The islands of the *Greater Oasis* are separated from each other by deserts of from two to 14 hours travelling. The whole extent of the chain is about 100 English miles, but by far the greatest part of it is desert. The whole Oasis is subject to Egypt, and has ever been reckoned an appendage to it, being distant from it about 90 miles. This Oasis contains abundance of date trees, and plenty of good water. The principal village in it is called *Chagré*, and is situated in 26° 25' N. Lat. and 29° 40' E. Long.

The *Lesser Oasis* does not lie in any of the tracks of the caravans, and is therefore little known. It is understood, however, to begin at the distance of about 40 miles to the northward of the *Greater Oasis*, and to proceed to a considerable distance in a direction towards the north. It is called by the neighbouring Arabs *Al Wah-el-Gherbi*, which appears to mark poverty or inferiority, perhaps, in comparison with the other. It consists, like the *Greater Oasis*, of a chain of narrow islands running parallel to the Nile.

The third Oasis contained the celebrated temple and oracle of Jupiter Ammon, which was visited by Alexander the Great. Though in its dimensions it is perhaps less than the two former Oases, it is undoubtedly the greatest so far as historical importance is concerned. In the time of Herodotus, the state or kingdom of Ammon occupied a considerable space betwixt Egypt on the east and the desert of Barca on the west, and between the Nomadic tribes along the coast of the Mediterranean on the north, and the great Libyan

Africa. Libyan desert on the south.—As the ancient Persians worshipped one supreme deity whom they represented by the sun, and as they had a regular and well disciplined priesthood, they were taught to regard with indignation the idolatry of the Greeks. Hence the Persian monarch Cambyses sent an army against the Ammonians, with orders to burn the temple from whence the oracles of Jupiter were delivered. The expedition was unsuccessful, the army having been overwhelmed with sand, or left by their guides to perish in the desert; so that no remnant of them ever returned.—The position of the Oasis of Ammon has lately been ascertained by our countryman Mr Brown, who travelled into that quarter with a view to its discovery. It appears to correspond with the modern Siwah, in $29^{\circ} 12' \text{ N. Lat. and } 26^{\circ} 18' \text{ E. Long.}$ As a building of such antiquity must be an object of great curiosity, we shall transcribe Mr Brown's description of the small part of the temple that remains, the rest having been destroyed by the modern inhabitants of the country to build their houses and garden walls. "It is a single apartment," says Mr Brown, "built of many stones of the same kind as those of which the pyramids consist, and covered originally with six large and solid blocks that reach from one wall to the other. The length I found 32 feet in the clear, the height about 18, the width 15. A gate situated at one extremity forms the principal entrance, and two doors also near that extremity open opposite to each other. The other end is quite ruinous; but, judging from circumstances, it may be imagined that the building has never been much larger than it now is. There is no appearance of any other edifice having been attached to it, and the less so, as there are remains of sculpture on the exterior of the walls. In the interior are three rows of emblematical figures, apparently designed to represent a procession; and the space between them is filled with hieroglyphic characters, properly so called. The soffit is also adorned in the same manner; but one of the stones which formed it is fallen within, and breaks the connection. The other five remain entire. The sculpture is sufficiently distinguishable; and even the colours in some places remain."

Brown's description of the temple. Mr Horneman, a native of Germany, a traveller employed by the African Association, has still more recently visited Siwah, on his way from Cairo to Fezzan along with a caravan, in which he travelled under the character of a Mahometan merchant. He seems to think, that the total circumference of the ruins of the ancient temple of Jupiter Ammon may be several hundred yards, though in many places the outward wall has been entirely carried away. He seems to have measured the outside of the same building whose inside appears to have been measured by Mr Brown, and accordingly describes the length as from 30 to 36 feet, the width 24, and the height 27; but he was interrupted in taking his measurements by the jealousy of the natives. He also describes the ceiling as formed of vast blocks of stone of four feet in breadth, and three feet in depth, which extend across the whole building; and this roof seems to have preserved this part of the fabric entire, as the present barbarous inhabitants dare not attempt to demolish the walls, lest they themselves should be overwhelmed by the fall of the stones which form the roof. One of these stones of the roof

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The fertile part of the territory of Siwah appears State of to be about 18 miles in circumference, containing several small villages besides Siwah the capital. It is an independent state, acknowledging the Grand Seigneur as lord paramount, but paying no tribute. It affords abundance of vegetable productions, with corn and oil; and is copiously supplied with water from springs and small streams, but none of them flow beyond its territory. They are either evaporated on approaching the surrounding desert, or, if they reach it, are lost in the sterile sand. Its government is vested in about 32 wealthy citizens, who assume the title of *scheiks*. Justice is administered according to ancient usage and general notions of equity. Fines, which are paid in dates, constitute the punishment. The dress of the men consists of a white cotton shirt and breeches, and a large piece of callico cloth striped white and blue, manufactured at Cairo, which is thrown over the left shoulder, and is called *melaye*. On their heads they wear a cap of red worsted or cotton, which is the distinction of a Mussulman, no Jew or Christian being permitted to use it. The women of Siwah wear wide blue shifts, usually of cotton, which reach to the ankles, and a *melaye*, above described, which they wrap round their head, and which falls over the body like a cloak. They plait their hair into three tresses one above the other, and fasten little bells to the lowest. They wear ear-rings and necklaces of glass beads. Those of the higher class wear round their necks a solid ring of silver thicker than the collar usually worn by criminals in some parts of the continent of Europe. There are many catacombs in the neighbourhood of Siwah, which formed the burying places of the ancient inhabitants, which show great labour and neatness of work.

The same traveller, Mr Horneman, on his way towards Fezzan, passed through Augila, an island or oasis in the desert, that was well known in the days of Herodotus. It is situated in $33^{\circ} 3' \text{ N. Lat. and } 22^{\circ} 46' \text{ E. Long.}$ The territory contains three towns, Augila the capital, Mojabra, and Meledila. Many of the inhabitants engage in the caravan trade. Those who do so, very frequently have three houses, one at Cairo, one in the territory of Augila, and a third in Fezzan, with a wife and family establishment at each. The country is level, and the soil sandy, but being well watered it is tolerably fertile. After a march of 16 days from Augila, Mr Horneman reached Temissa, in the territory of the important oasis Fezzan, of which we shall now give some account upon the authority of the journal which he has very recently transmitted to Europe.

Fezzan, the country of the ancient Garamantes of Herodotus, called by Pliny *Phazania Regio*, is upwards of 1100 miles west from Grand Cairo, and consists of an extensive plain amidst a surrounding wilderness of sand and of naked rocks.

The greatest length of the cultivated part of Fezzan

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is about 300 English miles from north to south, and its greatest breadth from east to west is 200 miles. It contains 101 towns and villages, of which Mourzouk is the capital, situated according to Rennel, in $27^{\circ} 48'$ N. Lat. and $15^{\circ} 3'$ E. Long. The principal towns to the northward of the capital are Sochna, Sibha, Hun, and Wadon; Gatron to the south; and Quila to the east. The climate is never temperate. During summer the heat is intense, and the south wind is scarcely supportable even by the natives. A penetrating north wind prevails during winter, which drives to the fire even the natives of a northern country. Tempests of wind are frequent, which whirl up the sand and dust so as to give a tinge of yellow to the atmosphere. Rain falls seldom, and in small quantities. There is no river, nor even a rivulet deserving notice, throughout the whole country. The soil is what in Europe would be called a light sand, covering calcareous rock or earth, and sometimes a bottom of clay.

Produce of Fezzan.

Dates are the staple produce of Fezzan, and in the western parts some senna of a good quality is cultivated. Pot herbs are plentiful. Wheat and barley are suited to the soil and to the climate: but from the indolence of the people, and the oppression of the government, enough is not raised for the supply of the inhabitants, and they rely for a part of their subsistence on importations from the north. Horned cattle are only found in the most fertile districts. They are employed in drawing water from the wells, and are only slaughtered in cases of extreme necessity. The goat is the ordinary domestic animal, though sheep are bred in the southern parts. The wool is manufactured into coarse cloths, and along with the meat the skin is roasted and eaten. Horses are few. Asses are the beasts of general use, whether for draught or burden. Camels are excessively dear, and only kept by the chief people.

Mechanics of Fezzan.

There are no other tradesmen in Fezzan than shoemakers and smiths, the latter of whom work every metal; and the same man forges shoes for the sultan's horses, and makes rings for his princesses. The value of the woollen cloth, which is manufactured by the women, may be estimated from this circumstance, that the weavers shuttle is unknown, and that the wool is inserted into the warp thread by thread, and the whole worked solely by the hand. Hence it happens, that though the commerce of Fezzan is considerable, it consists merely of foreign merchandise, brought by caravans from various quarters, which are here disposed of as at a central market. Cairo sends silks, calicoes, woollen cloths, glass, imitations of coral, beads, and East India goods. From Tripoli, a caravan brings paper, false corals, fire-arms, sabres, knives, cloths called *abbés*, and red worsted caps. From Bournou, on the south-east, copper is imported in great quantities, and the caravans from the south or west bring slaves of both sexes, ostrich feathers, zibette, tigers skins, and gold, partly in dust, partly in native grains, to be manufactured into ornaments for the people of interior Africa. The smaller caravans of the tribes of the desert import oil, butter, fat, and corn, and those from the more southern districts bring senna, ostrich feathers, and camels for the slaughter-house.

Government.

Fezzan is governed by a sultan, descended from the family of the shereefs; but he pays 4000 dollars annually, as a tribute to the basha of Tripoli; and in

his correspondence with that basha, he assumes only the title of scheik, instead of sultan. The throne is hereditary, but the eldest prince of the family succeeds, though a brother or a nephew, to the exclusion of the children of the last sultan, if they are younger. This law gives rise to many civil wars between the sons of their sultans and the collateral branches of the family.

The sultan's house or palace is within the fortress of Mourzouk. He has no other inmates than eunuchs. His harem is contiguous. It consists of about 40 slaves, who are often sold and replaced by others if they have no children, and of a sultana, who must be of the family of the shereefs of Wadan or Zuila. The sultan never enters the harem, but any female whom he wishes to see is conducted to his apartment.

The sultan gives audience three times a-day, in a particular apartment, seated on an old-fashioned elbow chair, raised some steps, which forms his throne. Persons introduced kiss the hand of the sultan, then raise it so as to touch their foreheads, and then kneel before him. The sultan goes on Fridays to the great mosque on horseback, and on other days of solemnity he rides on a plain near the town, attended by his courtiers, who exhibit their skill in equestrian exercises and in shooting. His official attendants consist of two ministers, and of a number of black and a few white slaves, termed Mamelukes. All the interest and power rest with these Mamelukes, who are mostly Europeans, or their immediate descendants. The apparel of the sultan, on days of ceremony, consists of the Tripolitan dress, over which he wears a large white embroidered shirt, made after the fashion of the Negroes. His turban extends a full yard from the front to the hinder part, and is two-thirds of a yard in breadth. His revenues consist of assessments on all cultivated lands, and of arbitrary requisitions, which are collected by his slaves in an oppressive manner, if they are not bribed. He also derives an income from duties on foreign trade, from certain territorial domains, and from salt pools and natron lakes. The present sultan has added to his treasures by predatory expeditions against the weaker tribes in the neighbourhood of his country. The chief booty upon these occasions consists of men and women, who are sold as slaves. The princes of the royal family are supported from certain territories allotted to them, together with a weekly distribution of corn from the sultan's stores, and occasional exactions from the people.

The clergy and the *cadi* or chief judge, are supported by the produce of certain woods and gardens; and they possess great authority with the people. The dignity of *cadi* is hereditary in a certain family; but the sultan, upon every vacancy, appoints to the office that individual of the family who can best read and write, accomplishments which here seem to be somewhat unusual, and therefore much valued.

The population of Fezzan amounts to about 70,000 or 75,000 souls. In the southern districts they have mixed with the natives of the desert, whom they resemble; but the original Fezzanians are a people of ordinary stature, of a deep brown complexion, with short black hair and regular features. They possess little energy either of mind or body. Almost their only food consists of dates, or of a kind of farinaceous pap, with no butcher's meat. The men who can afford it are much addicted.

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Palace harem.

Ceremonies.

Dress of the sultan.

Revenues.

Population.

Character.

addicted to drunkenness. They use a very intoxicating liquor prepared from dates. The women have a great fondness for dancing, which they practise publicly, not only in the day time but after sunset. The amusement is thus described by Mr Horneman: "Two or three men stand together with their tambourins; the women immediately form a circle round the men, beat a tune, and those in the circle accompany it with singing and clapping of hands. A girl then advances dancing towards the drummers; the men as she approaches near them, join in the dance, and press towards her, on which she makes some steps backwards, and then falls on her back with her body and limbs stiff and perfectly straight; when the women behind catch her in the fall, a few spans from the ground, and toss her in the air, whence she descends on her feet. The men then resume their station in the centre, and a second female dancer repeats the sport, which is successively engaged in by each brisk damsel of the circle."

In Fezzan there are a great number of loose women, and also of singing girls whose song is Sudanic, that is derived from the country of the Negroes. Their musical instrument is called *rhababe*; it is an excavated hemisphere, made from a shell of the gourd kind, and covered with leather; to this a long handle is fixed, on which is stretched a string of horse hairs longitudinally, closed and compact as one cord, about the thickness of a quill. This is played with a bow.

Various sorts of venereal disorders prevail in Fezzan; but it is worthy of remark, that, for the cure of all the species, they only use salts and the fruit *handal* (colocynth) as powerful cathartics; the sores, if any, are at the same time washed with a solution of soda: and these remedies seldom fail. Other maladies prevalent there are the ague and hæmorrhoids, for neither of which have they any other remedy than amulets, consisting of certain sentences of the Koran written on a slip of paper, which the patient wears about his neck, and in bad cases is made to swallow. It is said, however, that their knowledge of surgery is sufficient to enable them to cure a simple fracture.

South from Fezzan a variety of other islands are scattered, which have been united by conquest under one chief, and receive the name of the empire of Cassina or Kasseena. The territories of this empire, therefore, consist of a considerable quantity of land of amazing fertility, interspersed with arid wastes, where the rays of the sun, reflected from the sand or the rocks, produce the most intense and suffocating heat. Cassina, the capital, is situated in N. Lat. $16^{\circ} 20'$. W. Long. $11^{\circ} 45'$. Agadez, which is an island, or province as it may be called, of the empire of Cassina, sends annually a caravan of 1000 camels to certain salt lakes in the desert, at a place called Dombou; and the salt is distributed among the other islands or provinces of this empire.

A similar empire, as travellers are pleased to call it, consisting of a number of fertile spots of this immense desert, is called Bornou. Mathan, the capital, is situated in N. Lat. $24^{\circ} 32'$. E. Long. $22^{\circ} 57'$. It is surrounded by a ditch, and a wall 14 feet in height. The king is said to be more powerful than the emperor of Morocco. His dominions extend beyond the desert into the fertile country of the Negroes, of which he pos-

sesses a large portion. He is elected by three of the principal chiefs; but the choice is restricted to the royal family. The military force of the state consists of cavalry armed with the sabre, the pike, and the bow. Fire arms are not unknown, but they are too difficult to be procured.

Besides these, there is a variety of other districts in this desert, of which some slight intelligence has been obtained; such as Gadamis, north-west from Fezzan, about N. Lat. 32° ; south-east from which is another island, called *Tuat*, at the distance of about 400 miles. On the south-east of Fezzan is Tibesti, at the distance of 200 miles: eastward of which, and 500 miles from the Nile, is Bardoa. Zegzeg and Kur are in the same vicinity. Farther to the south is Bergoo and Darfoor. This last lies to the southward of the general latitude of the great desert. It has of late years been made known by Mr Brown, the first discoverer of the Oasis of Ammon. He penetrated into Darfoor in 1792, and remained there a considerable time. Its chief town, Cobbé, is situated in $14^{\circ} 11'$ N. Lat. and $28^{\circ} 8'$ E. Long. and the country contains about 200,000 inhabitants, consisting of native tribes of a deep black complexion and woolly hair, though with features different from those of the Negroes, and of Arabs of various tribes. The wild animals are, the lion, the leopard, the hyæna, the wolf, and the wild buffalo. The domestic animals are, the camel, the sheep, the goat, and horned cattle. Considerable quantities of grain of different sorts are reared, and, as the country is within the tropics, after the periodical rains the fertility is very sudden and great. The people are very barbarous. The practice of polygamy is not only established, but the intercourse of the sexes is totally destitute of delicacy or decency. The most severe labours of the field are left to the women; and the houses, which are of clay covered with thin boards, are chiefly built by them. Salt is the general medium of commerce at Darfoor, as gold dust is in many other places of Africa. This territory is governed by a chief, who calls himself sultan, and assumes the most extravagant titles. Darfoor He appears in public on a splendid throne, while an officer proclaims, "See the buffalo, the offspring of a Extraordi-
buffalo, the bull of bulls, the elephant of superior nary titles.
strength, the powerful sultan Abd-el-rachman-el-rashid.
May God preserve thy life! O master, may God assist, and render thee victorious!"

These islands of the African desert are too little known to render valuable any attempt at a more minute description of them. They all resemble each other in the fertility of their soil and the barbarous state of their inhabitants, who are Mahometans, unless where they approach the country of the Negroes. Though they maintain towards each other the maxims of apparent hospitality, yet a Christian is everywhere odious; and they account it meritorious to persecute or enslave him. Their language is chiefly a dialect of the Arabic, and their literature is in a great measure confined to reading the Koran. Their only intercourse with other nations is carried on by the caravans which periodically traverse these immense deserts: and the smaller islands, that are neglected by the caravans, are sometimes absolutely forgotten by the rest of the world for many years; and their inhabitants, left to themselves and to their native ignorance, at last im-

agine,

Africa. gine, that, except their own little territory, the whole earth resembles the great desert which they see around them.

Tribe of Monselemines in Western Africa.

Government.

Productions.

Rude agriculture.

Wars.

Manners.

It is to be observed, that the Sahara, or great wilderness, does not on its western boundary all at once attain its utmost degree of barrenness. Immediately to the south of Morocco and of the mountains called Mount Atlas, is a considerable extent of territory inhabited by a tribe called the *Monselemines*. In their manners, they differ considerably from the Moors on the coasts of the Mediterranean, and also from the Moors or Arabs of the desert. Their civil government is republican, as they choose new chiefs every year, who are accountable to the aged men of the community. It is probable, however, that order is preserved among them chiefly by the influence of their priests, who are greatly respected; and the influence of the high priest amounts almost to despotic power. The people are chiefly engaged in a sort of pastoral life, to which agriculture is occasionally united. They have also villages in which various tradesmen reside, chiefly weavers, shoemakers, smiths, and potters, who have no cattle: But some opulent persons residing in the towns have flocks and herds of cows, horses, camels, sheep, and goats, besides poultry, kept by slaves at a distance in the country. The soil possesses considerable fertility, and produces the necessaries of life with little cultivation. The plains abound with date, fig, and almond trees; and grapes are cultivated. Oil, wax, and tobacco, are also produced, and sold in the villages. Their agriculture is very rude. The chiefs of families, or small tribes, choose the ground most fit for cultivation. Its surface is slightly turned over with a kind of paddle, for the plough is unknown; and then the seed is sown upon it. The spot is then deserted by the inhabitants, who wander in all directions with their cattle, and do not return till harvest, when the corn is cut down and thrashed. Magazines are then formed, consisting of holes in the earth, into which the corn is put. Planks are laid over it, which are covered with a layer of earth, made level with the soil, to prevent its being discovered by enemies. These magazines belong to every chief of a family or tribe, in proportion to the number of men he employed in the common labour.

The *Monselemines* are almost constantly engaged in war against the emperor of Morocco. They are extremely jealous of their independence and freedom; and their country is the retreat of all the discontented Moors. No sooner does the emperor of Morocco take the field against them, than the whole inhabitants of the country districts mount their horses; and, while a part of them escort the women and slaves, and cattle, to places of safety, or even into the desert if they are close pressed, the rest of them occupy the passes of the mountains, and meet the enemy. During peace, parties of them often undertake to escort caravans, by which means there is preserved among them a considerable military spirit. In other respects they bear a great resemblance to the ancient Arabs. They permit polygamy, but their women are not so much secluded from society as among the Moors on the seacoast. Their children are brought up with care; and are not considered as men till they exhibit some proofs of their courage. Jews are permitted to live among

them in their villages, but they are not allowed to cultivate the earth, or to carry arms. Christians are much hated; but a Christian slave is better treated than among the other Arabs, because the avarice of the *Monselemines* is greater than their fanaticism. As their slaves constitute their riches, they treat them tolerably well from a principle of prudence.

To the south of the country of the *Monselemines*, upon the coast of the Atlantic, is the wandering tribe of *Wadelims*; to the south of whom are the *Labdessebas*: And next to these are the *Trasarts*, who border with the country of the Negroes. Eastward along the northern frontier of the Negroes lie the Moorish states of *Jaffnoo*, *Ludamar*, and others. With the exception of these small states, it is to be observed, that the great desert, or Sahara, reaching from the Atlantic ocean to the frontiers of Abyssinia, and from the vicinity of the Mediterranean to the country of the Negroes, is possessed by two great Moorish nations called the *Tuarick* and the *Tibbo*. Of these the *Tuarick* is the most powerful: It consists of the whole desert and Tibbo westward from the meridian of Fezzan. The desert, of Sahara, eastward from the same meridian, belongs to the *Tibbo*. The manners and character of the whole of these tribes, whether great or small, is nearly or altogether similar. The desert which they inhabit is parched and uncultivated. Many places of it have the appearance of being capable of cultivation, as shrubs grow in various situations; and palms, or dates, rise at distant intervals. But the flying sand is the great obstacle to cultivation, by rendering the result of it uncertain. The sand drifts with every gale, and is at times accumulated into high mountains, which disappear as the winds blow. Thus it is shifted about with every change of the blast, excepting when the air is entirely stagnant. When the sand shower becomes formidable, the Moors are obliged to load their camels, turn their backs to the gale, and hasten away, to avoid being buried alive.

As water is very scarce in the desert, the Arabs or Moors form large holes for reservoirs to collect the rain water, which, though it soon becomes putrid and disgusting, is the only drink of man or beast. From the scarcity of water, they have few horned cattle; and their flocks consist chiefly of sheep, goats, and camels, animals which are patient of thirst. None but the wealthiest Arabs, who possess numerous herds, are able to maintain horses, as it is often necessary to give them milk to drink instead of water. The urine of the camels is carefully preserved to wash the vessels used to contain food; and the Arabs are frequently under the necessity of drinking it, mixed with milk, for the purpose of allaying their thirst. As their riches consist of their herds and flocks, they attend them with the greatest care. If a beast be sick, it is attended with more anxiety than a man; but if it seem likely to die, they kill and eat it. If it die before its blood be shed, it is accounted unclean, and is never eaten.

The Sahara, or desert, abounds in antelopes, wild boars, leopards, apes, and serpents. The Arabs or Moors are expert hunters, and, as the leopard's skin is an article of commerce, that animal, from being frequently attacked, learns to keep at a distance from their habitations. Hunting the ostrich is a favourite amusement. It is undertaken by about twenty horsemen who

who advance in a line against the wind, at the interval of a quarter of a league behind each other. As soon as the foremost perceives an ostrich, he rushes upon it. The ostrich cannot fly; but with the assistance of its wings, it runs in the direction of the wind, and though it may avoid a few of the Arabs successively, cannot escape the whole number. In their hordes, the Moors or Arabs lodge by families in tents covered with a cloth of camels hair, which the women spin and weave. The furniture of the tent consists of two large sacks of leather, in which they keep their clothes and pieces of old iron, a few goat skins for holding milk and water, two large stones for grinding their barley, a mattress of osier which serves for a bed, a carpet for a covering, a small kettle and some wooden dishes, with pack saddles for their camels. They often associate to convey salt, which abounds in the desert, into the country of the Negroes; for which, in return, they bring back provisions and blue cotton cloth and slaves. They also associate for war and for hunting; and in most cases, where the property acquired consists of goods which can be packed up into parcels, they divide it into shares, which they cover up, and fix upon a woman, a child, or a stranger, who knows nothing of the contents of the various parcels, to distribute them by hazard to the different associates of the enterprise.

The only artificers among the Moors of the desert, are smiths, or a kind of tinkers, who go among them from the country of the Monselemines to mend their broken vessels, or repair their arms, and are paid in skins, goats and camels hair, or ostrich feathers, according to agreement. All of them are more attentive to their arms than to their dress; the latter of which often consists only of a long blanket which they wrap round them, with a cloak of camels hair, and more frequently of goats skins. They wear loose frocks or shirts, however, of blue cotton cloth, if they can procure them from the Negroes, by whom this cloth is manufactured. Their arms consist of daggers and clubs, with sabres and muskets if they can obtain them. To this general description of poverty, however, some of the Moors of the great inland nation or tribe of Tuarick form an exception, in that part of the desert which borders upon Fezzan, where they have an opportunity of acquiring wealth by engaging in the caravan trade. Mr Horneman saw at Fezzan many individuals of the Hagara, one of the tribes of the Tuarick, and describes them thus: "The Hagara are yellowish, like the Arabs; near Soudan, there are tribes entirely black. The clothing of this nation consists of wide dark blue breeches, a short narrow shirt of the same colour, with wide sleeves, which they bring together and tie on the back of their neck, so that their arms are at liberty. They wind a black cloth round their head in such a manner, that at a distance it appears like a helmet, for their eyes only are seen. Being Mahometans, they cut off their hair, but leave some on the top of the head, round which those who wear no cap contrive to fold their black cloth, so that it appears like a tuft on their helmet. Round their waist they wear a girdle of a dark colour. From several cords which fall from their shoulders hangs a Koran in a leather pouch, and a row of small leather bags containing amulets. They always carry

in their hands a small lance neatly worked, about five feet long. Above the left elbow, on the upper part of the arm, they wear their national badge, a thick black or dark-coloured ring of horn or stone. Their upper dress is a Soudanian (Negro) shirt, over which a long sword hangs from the shoulder. The travelling merchants of this nation carry fire arms, though others use only the sword, the lance, and the knife, which they carry on their left arm; but the handle is finely worked; for they have the art of giving to copper as bright a colour as the English artists, and this art they keep very secret. They carry on a commerce between Soudan, (i. e. Nigritia), Fezzan and Gadamis. Their caravans give life to Mourzouk, which without them is a desert; for they, like the Soudanians (Negroes) love company, song, and music. The Tuarick are not all Mahometans. In the neighbourhood of Soudan and Tombuctoo live the Tagama, who are white, and of the Pagan religion."

Hospitality is the most remarkable virtue of the Moors, or Arabs of the desert. The chief of a horde is by custom bound or entitled to entertain all strangers; but every tent contributes to his stock of provisions. When a stranger reaches an Arab horde, the first person who perceives him points out the tent of the chief. If the master is not present, the wife or the slave comes forth to meet him, and brings him milk to drink. His camels are then unloaded, and his effects ranged around him. His arms are deposited near those of the master of the tent. The Arab, who in the field is a rapacious plunderer, in his tent is generous and hospitable; and the person of an enemy is inviolable, though he should have killed the near kinsman of its master. All this, however, is chiefly to be applied to persons of their own religion; for towards Christians and Jews, their fanaticism renders them extremely intolerant. A Jew, more especially, if discovered, can scarcely escape alive from among them.

Polygamy is allowed among the Arabs of the desert, as among other Mahometans; but it is very effectually restrained by the poverty of the people. Divorce is permitted at the will of either party; but if a male child is born, the marriage becomes indissoluble. In the education of children force is never employed. The priests, who are the teachers, instruct them to read the Arabic characters and sentences of the Koran; but if the child become weary of the school, he quits or returns to it at pleasure, without being reproached.

Property descends by inheritance in equal shares to the male children; but the females have no share, and are obliged to reside with their eldest brother. The chief of the horde becomes the guardian of the children who are left orphans. Property is ill secured by their customs. If a thief is caught in the fact he may be punished; but if he escape with his booty, it cannot afterwards be claimed.

The abstinence and hardships which the Moors of the desert are frequently under the necessity of encountering, and their habits of predatory war against passing caravans, or hostile tribes, bestow upon them an evident superiority over the more peaceful tribes of Negroes who inhabit the fertile regions of the south. They possess also the knowledge of writing, and of the Arabic language, which inspires them with no small confidence of the importance of their own character and

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and accomplishments. Hence, they assume a haughtiness of gait, and a ferocity of aspect, which distinguishes them no less than their complexion from the Negroes in their neighbourhood. Such is the presumption resulting from these sentiments, that though a small party of Negroes would never risk themselves in the desert, one or two Moors will travel with impunity through all Africa, and plunder the Negroes by whom they have been entertained.

As the equator passes almost through the centre of Africa, by far the largest portion of that great continent is situated within the torrid zone, and is possessed by the Ethiopians and Negroes, who are called by the Arabs *Biled al Soudan*, or *Biled al Abiad*, the land of blacks, or the land of slaves. In all countries within the tropics, excessive rains fall twice every year about the time of the vernal and of the autumnal equinoxes. At these periods every river is swelled into a mighty flood, and if the country be level it is completely inundated. From this circumstance, along with the heat of the climate, arises the extreme fertility of the middle regions of the globe.

Periodical rains.

Though the *Sahara*, or great African desert, extends a few degrees beyond the tropic of Cancer, yet its boundaries begin to be ill defined; fertile spots become more frequent: and at last, in the latitude of the Cape de Verd isles, and in the neighbourhood of the first rivers, the Senegal and the Niger, the gum forests mark the commencement of the land of the Negroes. About 600 miles from the western coast, in the mountains of Kong, the river Senegal takes its rise, and flows westward into the Atlantic ocean. The same mountains are the source of the great river of the Ethiopians, the Niger, the knowledge of which, from the time of Herodotus, seems to have been lost by the European nations, and has only been recently restored in consequence of the intrepid and persevering exertions of our countryman Mungo Park, who had been employed by the African Association to endeavour to discover whether its existence ought to be regarded as a reality or as an error of the ancient geographers. It runs eastward; but its termination, as will be afterwards noticed, is still unknown.

Negroeland.
River Senegal.

Niger.

To the south of these rivers, all Africa belongs to various nations of Negroes, among whom considerable varieties of appearance and of character exist. In general, however, they are distinguished by short woolly hair, flat noses, thick lips, and black complexion, while their intellectual powers have been supposed by some to be inferior to those of the civilized European or Asiatic nations. Some modern writers, however, such as Bruce and Volney, are of opinion, that the elements of the arts and sciences came originally from Upper Egypt and Abyssinia, and the ancients appear to have ascribed to the Ethiopians the commencement of civilization among mankind. "The Thebans (says Diodorus) consider themselves as the most ancient people on the earth; and assert that with them originated philosophy and the science of the stars. Their situation, it is true, is infinitely favourable to astronomical observation, and they have a more accurate division of time into months and years than other nations." The same opinion he attributes to the Ethiopians. "The Ethiopians conceive themselves to be of greater antiquity than any other nation; and it is probable that,

born under the sun's path, its warmth may have ripened them sooner than other men. They suppose themselves also to be the inventors of divine worship, of festivals, of solemn assemblies, of sacrifices, and every other religious practice. They affirm that the Egyptians are one of their colonies; and that the Delta, which was formerly sea, became land by the conglomeration of the earth of the higher country, which was washed down by the Nile. They have, like the Egyptians, two species of letters, hieroglyphics and the alphabet; but among the Egyptians, the first was known only to the priests, and by them transmitted from father to son, whereas both species are common among the Ethiopians." "The Ethiopians (says Lucian) were the first who invented the science of the stars, and gave names to the planets, not at random and without meaning, but descriptive of the qualities which they conceived them to possess; and it was from them that this art passed in an imperfect state to the Egyptians."

But though the antiquity of the civilization of Egypt cannot be disputed, there is little reason to believe that the middle regions of Africa ever exhibited the human character in a higher state of cultivation than it now possesses there. In all ages its inhabitants were engaged in the barbarous practice of selling each other into slavery to distant nations. No remains of ancient magnificence are to be found in their country, nor any instruments of art which mark the genius of an improved people. Even the plough is still unknown, and the ingenuity of man is only exerted to supply his most simple wants.

No trace of refinement found in Africa.

A great part of the country of the Negroes receives among Europeans the name of Guinea, a term as old as the time of Ptolemy, who applies it to the maritime districts, though this name is said to be utterly unknown to the natives of the country themselves, excepting where they have learned it from European traders. It would appear, however, to have originated from one of the central states or empires of Africa, upon the banks of the Niger, which though once possessed of great power, has now fallen into decay, and is lost in the empire of Tombuctoo, and some neighbouring states.

Ancient name.

The middle regions of Africa bring to maturity all the tropical productions or fruits in their utmost perfection and abundance. With the slightest cultivation, rice, maize, millet, sugar, cotton, indigo, &c. are raised, along with some fruits peculiar to itself, among which may be mentioned the shea-tree, from which the vegetable butter is prepared, which forms a principal article of commerce in all the interior districts. The shea-tree is said to resemble the American oak; the butter is prepared from the kernel of the fruit. This kernel resembles a Spanish olive, and is enclosed in a sweet pulp under a thin green rind. It is dried in the sun, and then boiled in water. Travellers tell us that the butter produced from it is white, firm, and better flavoured than that of milk. If this account of it be correct, which we have no reason to doubt, measures ought certainly to be taken for conveying this tree to the European settlements in the West Indies, and for cultivating it there, as it would undoubtedly be very valuable when reared in the vicinity of the bread-fruit tree, which has lately been brought from Otaheite.

Produced in the middle regions.

Vegetable butter.

Various

Africa. Various species of wild beasts inhabit this country, as lions, leopards, hyænas, elephants, buffaloes, wild boars, rhinoceroses, with great variety of the species of deer, and various kinds of monkeys. Innumerable species of snakes are also to be found here; one of the most remarkable of which, called the *singacki*, is of a pale green colour with black spots, about a foot in length, and as thick as a man's finger. It possesses the power of ejecting a subtile vapour into the eyes of any animal that approaches within the distance of two or three feet, so as to occasion extreme pain for several days, and even incurable blindness. Another species of snake, said to be found also in Ceylon, grows here to the enormous size of 50 feet in length; the colour of the back is dark gray, with lines of a dusky yellow: part of the belly is of a lighter colour and spotted: it lurks, in moist situations, wreathed into curls, which include a space of about five feet diameter, and give it at a distance some resemblance to the mouth of a well. Over these curls or rings it rears its head and part of its body, and remains immoveable till some animal approach within its reach, when it darts upon it; and, if the animal is large, twists its body round it, and with an immense force crushes all its bones; and having lubricated it with saliva, swallows it entire. After having devoured in this manner a large animal, the snake remains as if lifeless for many days during the process of digestion, and in this situation may be easily destroyed. The **cameleon** is also found in this country, along with an immense variety of reptiles. Of these, ants are the most formidable and destructive to man. They differ in size, from an inch in length to a minuteness that is almost imperceptible to the naked eye. They sometimes burst from their nests in such innumerable myriads as to destroy every thing on the surface of the earth, and to oblige the natives to desert their habitations. They often extinguish fires by their numbers, and form bridges of their own dead bodies over shallow waters which impede their progress.—One species forms swarms like bees, and erects round pyramids of clay which becomes extremely hard. These pyramids are usually eight or ten feet high. Their interior consists of galleries suited to the size of the animal, interwoven like a labyrinth, having a small opening as a door or entry to the dwelling.

Monstrous spiders also exist in this country, a single thread of whose web, it is said, will support a weight of several ounces.

The natives of this country have too little art or industry to take much advantage of the metals with which the earth is supposed in many places to abound. In some situations, however, they produce iron of a tolerable quality; but gold is the chief object of their search. It does not appear, however, that they have ever wrought the mines of it which they have discovered to any depth, and it is chiefly procured from the sands of the rivers or of torrents after violent rains. It is then collected in some districts in considerable quantities, and forms an important article of commerce. Women chiefly engage in this employment, and an individual may collect in general during the dry season, as much as is equal to the value of two slaves. The gold obtained is either used in commerce or wrought into ornaments for the women. The stand-

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ard of value is called *menkalli*, which is equal in value to about 10s.

In general, however, it may be remarked, with regard to all the natural productions of this continent, whether animal, vegetable, or mineral, that they still remain in great obscurity, and present a vast field for the investigation of the natural historian.

The general character of the Negroes, who are the inhabitants of these fertile regions, is that of extreme levity. It is said, that they will dance for almost 24 hours together; and they do not suffer their gaiety to be disturbed by events, which, in other countries, are productive of much unhappiness. They do not appear to want the feelings of humanity, nor are they more destitute of sagacity than other men and women of an equal degree of education; but the general fertility of their country, which supplies them with food in consequence of the exertion of a very slight degree of industry, and the little occasion they have for clothing amidst the heat of their climate, produces an indolent and general habit of seeking present pleasure, and of banishing from their minds all care for the future.

The kind of government that exists among the Negro nations is by no means uniform. In many districts the country is governed by an immense multitude of independent petty chiefs, who are engaged in frequent wars with each other. In other places the talents of individual chieftains have been able to reduce considerable tracts of territory under their dominion. In such cases, in consequence of the internal tranquillity produced by the extension of the prince's power, flourishing towns have grown up. Thus upon the Niger stands the town of Sego the capital of Bambara, Town of which was visited by Mungo Park, and which lies in Sego. N. Lat. 14° 10', and W. Long. 2° 26', containing about 30,000 inhabitants. Two hundred miles below this upon the same river stands Tombuctoo, the great centre of the commerce of Fezzan, Cairo, and the countries on the north of Africa, with the land of the Negroes. Farther down the same river stands Houssa, Houssa, which is understood to be a city of still greater extent. Many of the Negro towns are fortified with ditches and walls, built like the houses of the natives of clay and stone. The trenches are sometimes flanked with square towers like a regular fortification, and the walls are very high.

Domestic slavery prevails in a very great degree among all the Negro states. As the tropical rains sometimes fail or are deficient in quantity, the scorching heat of the sun burns up the face of the country, and produces a most frightful barrenness. On these occasions it is not uncommon for parents to sell their children, and even themselves, for bread. A freeman may also lose his liberty by being taken prisoner in war, or on account of the real or supposed crimes of murder and sorcery. He also forfeits it in consequence of insolvency. From these causes domestic slavery prevails to such a degree, that in many places three-fourths of the natives are slaves. These slaves, however, form in some measure a part of the community; and, by the custom of the country, the master cannot sell one who is born his slave, without accusing him of a crime, a circumstance, which, in consequence

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of the slave trade, at times gives rise to much dissension, and to wars which resemble, in some measure, the sanguinary contests which existed in various countries in Europe, during the feudal times, between the villains and their lords. Thus, in 1785, a general insurrection took place in many districts on the western coast: the slaves attacked their masters, massacred great numbers of them, set fire to the ripe rice, blockaded the towns, and obliged them to sue for peace.

Arts in a rude state.

Few arts have been brought to much perfection by the Negroes, because the division of labour has been little known among them. The same individual spins, weaves, sews, hunts, fishes; forms baskets, fishing-tackle, instruments of agriculture; makes soap, dyes cloth with indigo, and makes canoes. In all these, the neatness of the work excites the astonishment of strangers who know the diversity of occupations in which the same individuals engage, and the imperfection of the tools with which they labour. They are no strangers, however, to that ordinary division of labour, to which nature herself seems to have given rise in consequence of the distinction of the sexes. The women spin, and the men weave the cotton cloth of which their dresses are composed. The cotton is prepared for spinning by rolling it with an iron spindle upon a smooth stone or board. The thread is well twisted though coarse; but the loom is so narrow that the web is only about four inches broad. The women dye this cloth with the leaves of indigo, pounded fresh, and mixed with a strong alkaline ley, formed by the lixiviation of wood ashes. The colour thus produced is a rich and durable blue with a purple gloss.

Weaving.

Dyeing.

Tanning.

The workers in metals, and the manufacturers of leather, appear to be almost the only instances of what may be called a separate profession existing among the Negroes. The manufacturers of leather separate the hair by steeping the hides in a mixture of wood ashes and water, and use the pounded leaves of a tree called *goo*, as we do the oak bark, for the purpose of tanning. They dye the skins of sheep and goats red with powdered millet stalks, and yellow with a root which abounds in their country. The manufacturers of iron smelt that metal in some of the interior districts; but it is generally hard and brittle. They form their weapons and tools of it, however, with considerable ingenuity. In smelting gold they use fixed alkaline salt, obtained by washing with water the ashes of burned corn stalks, and evaporating the ley to dryness. It must also be remarked, that, in the interior of the country, Mungo Park found a negro who manufactured gunpowder from nitre collected from the reservoirs of water frequented by the cattle, and sulphur supplied by the Moors, who obtain it from the Mediterranean. He pounded the ingredients in a wooden mortar, and granulated it; but the grains were unequal, and the strength of the gunpowder was very inferior to that of Europe.

Gunpowder.

The only necessary of life in which the country of the Negroes appears to be extremely deficient is salt, which is the more wanted among them in consequence of their subsisting chiefly upon vegetable food. A child cries for a piece of salt as for a great delicacy; and it is a proverbial expression of a man's riches, to say, that he eats salt to his food. This important article they receive from the great desert by caravans of

trading Moors. They also receive arms, hardware, glasses, and trinkets of all sorts, on the western coast from the Europeans, and, in the interior, from the caravans of Cairo, Fezzan, and Morocco. For these they give in return, gold, ivory and slaves. With regard to the ivory, the Negroes cannot comprehend for what reason it is so much valued by strangers. It is in vain to tell them that ships are built, and long voyages undertaken, to procure it to make handles for knives. They are satisfied that a piece of wood might serve the purpose as well, and imagine that it is applied to some important use which is concealed from the Negroes, lest they should raise the price of it. The trade of the Negroes is conducted by barter; and to adjust the value of their different articles of commerce, they appeal to a nominal standard, consisting of a certain quantity of any commodity for which there is a great demand. Thus on the Gambia, that quantity of ivory or of gold-dust which is estimated as equal in value to a bar of iron, is denominated a *bar* of ivory, or a *bar* of gold-dust.

A marvellous story has, in all ages, been told of a strange mode of conducting commerce that exists among certain African tribes who live in the wildest mountainous districts: they are said to engage annually in trade, but at the same time to seclude themselves from all personal intercourse with the traders who visit them: They traffic chiefly in gold-dust, which they bring to particular places, and there leave it upon the approach of the traders, who deposit quantities of goods which they are willing to give for the gold-dust, and thereafter retire. The natives then approach, and carry off the goods, or the gold dust, according as they think fit to accept or reject the bargain. From the days of Herodotus down to our own times, this story has been repeated by various writers, and in particular by Wadstrom, upon the authority of the chevalier de la Touch, vice-governor of Goree, in 1788, who is said to have visited the districts inhabited by these invisible traders.

The knowledge of the Negroes with regard to all speculative subjects, is extremely limited. Their notions of geography and astronomy, like those of other rude nations, are altogether puerile. They regard the earth as a vast plain, the boundaries of which are covered with clouds and darkness. The sea is a great river of salt water; beyond which is the land of the white people; and at a still greater distance, is the land to which the slaves are carried, which is inhabited by giants, who are cannibals. Eclipses are ascribed to enchantment, or to the interposition of a great cat, which puts its paw between the moon and the earth. They divide the year by moons, and calculate the years by the number of rainy seasons. They seem to believe in one God, who has power over all things; but their religious opinions are extremely undefined, so that it is in vain to expect to find among them any system of belief that is either universally received, or even consistently adhered to by the same individuals. They in general seem to think, that the god of the blacks or Negroes is different from the god of the whites: When they are pleased with their own condition and their country, they represent the black deity as a good being, and the white deity as a kind of devil, who sends the white people to make slaves of the

Africa.

Trade.

Medium commerce.

Singular mode of trading.

Knowledge of the Negroes extremely limited.

Religious opinion.

the Negroes: But when they are in ill humour, they complain of their black deity as mischievous and cruel; while they say that the white deity gives his people the Europeans brandy and fine clothes, and other good things which are denied to the Negroes. Their notions of a future state are of the same fluctuating nature. They have a confused idea that the existence of the human mind does not terminate with this life; and they seem to venerate the spirits of the dead, regarding them as protectors, and placing virtials at the graves of their ancestors upon stated occasions. In general, however, they regard death with great horror; and in Whidah it was a law, that no person, on pain of death, should mention it in presence of the king. Some of them have a notion of a future state as connected with rewards and punishments of their conduct in this life. They imagine that the deceased are conveyed to a mighty river in the interior regions of Africa, where God judges of their past lives, and particularly of the regularity with which they have celebrated the new moons, which among the Negroes are kept as festivals; and of the fidelity with which they have adhered to their oaths. If the judgment is in their favour, they are gently wafted over the great river to a happy country, resembling in description the paradise of Mahomet, where they enjoy plenty of all those things which they were accustomed to value in this world: But if the judgment is unfavourable, they are plunged into the river, and never heard of more. They also believe, like the vulgar of most other countries, that the ghosts of persons who have been guilty of great and unexpiated crimes, find no rest after death, but haunt or wander about those places in which their crimes were committed. The Asiatic doctrine of the transmigration of the souls of men after death into the bodies of other animals, is also entertained by some of them.

The opinions of the Negroes concerning the creation of man are not more fixed or definite than their ideas of his future existence. In general, they ascribe his original creation to the deity; but some of them pretend that he emerged, they know not how, from the caves and holes of the earth, or was produced by a monstrous spider. A curious fiction upon this subject is also said to prevail in some of the Negro states:—That God originally created both black men and white men; that he meant to bestow one gift upon each of them, gold or wisdom; that he gave the black men their choice, and that they preferred gold, and left wisdom or ingenuity to the whites; that God was offended with them on account of this improper choice, and ordained them to be slaves for ever to the white men.

They also believe in a divine providence, which sends rain to give fertility to the earth and the trees, and to wash down gold from the mountains. Accordingly, they pray fervently to God to give them those things upon which they set the greatest value, such as rice and yams, and gold, and slaves, and health, and activity. At the same time, from their inaccuracy of thinking upon this subject, they readily say, when conversed with, that it is not God but the earth that gives them rice; that their cattle produce young without the assistance of God; and that, if they did not labour for themselves, they might starve before God would help them.

From this loose and inaccurate mode of reasoning, the religion of the Negroes sits very light upon them. They seem to have a sort of priests, who perform some ceremonies at the new moons, and on certain occasions, such as, at marriages, or on giving names to young children; but these priests having no settled system of doctrine, and not being united into a disciplined body, possess very little influence. Hence it is extremely easy to induce the Negroes to adopt the religion of any more intelligent people. Accordingly, the Moors have made many converts among them; and some of the most considerable Negro states upon the northern frontier, that is, upon the Senegal and the Niger, are Mahometan.

But though the Negroes have little speculative religion, they have much superstition, as appears from the great use which they make of what are called *fetiches*, or charms termed *obi* by the Africans in our West-India islands. The fetiche consists of any natural object, which chances to catch hold of the fancy of a Negro. One selects the tooth of a dog, of a tiger, or of a cat, or the bone of a bird; while another fixes on the head of a goat, a monkey, or parrot, or even upon a piece of red or yellow wood, or a thorn branch. The fetiche, thus chosen, becomes to its owner a kind of divinity, which he worships, and from which he expects assistance on all occasions. In honour of his fetiche, it is common for a Negro to deprive himself of some pleasure, by abstaining from a particular kind of meat or drink. Thus one man eats no goats flesh, another tastes no beef, and a third no brandy or palm wine. By a continual attention to his fetiche, a Negro so far imposes upon himself, as to represent it to his imagination as an intelligent being, or ruling power, inspecting his actions, rewarding his virtues, and punishing his crimes. Hence he covers it up carefully whenever he performs any action that he accounts improper. The importance or value of a fetiche is always estimated according to the success of its owner, and the remarkable prosperity of an individual brings his fetiche so much into fashion, as to induce others to adopt it. On the contrary, when a Negro suffers any great misfortunes, he infallibly attributes it to the weakness of his fetiche, which he relinquishes, and adopts another that he hopes will prove more powerful. A fortunate fetiche is usually adopted by the whole family of its possessor, to which it becomes an object of reverence, or a guardian like the household gods, *dii lares* and *penates*, of the ancient Romans. Sometimes a whole tribe or a large district has its fetiche, which is regarded as a kind of palladium upon which the safety of their country depends. Thus at Acra the national fetiche was a lake, which the people accounted sacred. This lake was converted into a salt pit by the Portuguese, and the natives regarded this profanation as the cause of the conquest of their country by a neighbouring tribe called the *Aquamboans*. Thus also at Whidah, although the people believe in one supreme god, they worship as their national fetiche a kind of serpent of monstrous size, which they call the *grandfather of the snakes*. They say that it formerly deserted some other country, on account of its wickedness, and came to them, bringing good fortune and prosperity along with it. From this account of the fetiches of the Negroes, the intelligent reader will naturally remark, that even idolatry itself remains in an

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imperfect state among the people; and he will observe the difference between the polished superstition of ancient Greece and Rome, and the vulgar and unadorned credulity of these rude and artless tribes. In the vicinity of their settlements, the Moors have prevailed with the illiterate Negroes, to adopt as fetiches or charms, certain sentences of the Koran, which they write out and sell to them, under the name of *saphies*. Mingo Park, when travelling among them, sometimes sold saphies, which usually consisted of the Lord's prayer.

Singular customs.

Among the Negroes some singular customs prevail, which are not unworthy of notice, on account of their having some similarity to certain practices that have subsisted among other nations. Persons accused of any crime, more especially of poisoning, are frequently required to prove their innocence, by drinking what is called the *red water*. This is a poisonous liquor formed from the roots of certain plants, and the barks of trees, of a very narcotic quality. The accused is placed on a high chair, and stript of his clothes, having only a quantity of plantain leaves wrapt round his waist. He then, in presence of the whole village, eats a little rice, and drinks about an English gallon of the red water, which is extremely apt to find the accused person guilty. If he escape unhurt, however, and without vomiting, he is judged innocent. Much dancing and singing takes place on account of his escape, and he is allowed to demand that some punishment be inflicted on his accusers on account of the defamation. Among the superstitious customs of the Negroes, may be mentioned the practice of circumcision, which is universal among them. It is not regarded as a religious rite, but as a kind of charm for preventing barrenness. It is not performed till the age of puberty.

Secret societies of men.

In several Negro states certain secret societies or fraternities exist, which possess great political influence, and in some places absolute power. One of these societies, called the society of the *Belli*, is appropriated to men, to the exclusion of women. It supports itself by the use of mystical symbols, a pretence to the knowledge of important secrets, and by subjection to an imaginary being, called the *Belli*, who is said to be capable of changing his form at pleasure. This society monopolizes all public offices, to the exclusion of the uninitiated. The young men are introduced into it by a noviciate which lasts some years. A space is marked out of eight or nine miles in circumference in a fertile spot, in which huts are built, and provisions raised. The young men resort thither, and are taught by instructors pitched upon by the society, to fight, to fish, to hunt, and to sing certain songs peculiar to the fraternity; they also receive new names as a mark of their new birth, and certain scars are imprinted on their bodies, with heated instruments of iron, to point them out as belonging to the fraternity. On returning home after their initiation, they are received with great ceremony by their relations, as persons now introduced into public life.

Of women.

There is a kind of counterpart of this association, though of less political importance, called the society of the *Nessoge* or *Sandi*, which is confined to females. In a remote wood, which men are prohibited to approach, a number of huts are constructed, and the young marriageable girls are conducted thither during the night. They remain in this solitude, under the

care of certain matrons, during four months, and are taught a variety of religious customs and superstitions. When their noviciate is expired, they return by night to their villages, where they are received by all the women both old and young quite naked, who parade about with them, playing upon some rude musical instruments till daybreak. If any man should approach this procession, he would suffer death, or be compelled to redeem himself by a very heavy fine.

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There is a third kind of society, which is much more universal than those now mentioned, and seems to exist in all the Negro states. This society does not appear to have any special name, but it conducts the mysteries of a strange imaginary being, called *Mumbo Jumbo*. As the practice of polygamy exists very universally among the Negroes, they often find great difficulty in preserving the peace of their families amidst a variety of rival wives. When the husband finds his authority altogether contemned, he has recourse to the assistance of *Mumbo Jumbo*. The dress of this strange minister of justice usually hangs upon a tree in a forest in the neighbourhood of every Negro village. It is made of bark, and forms a figure of about eight or nine feet high, with a tuft of straw on his head. When *Mumbo* is about to appear, he announces his approach in the evening by dismal screams from the adjacent woods, and as soon as it is dark he enters the village, and proceeds immediately to the public place, where all the inhabitants both male and female are obliged to assemble at his call; for this phantom has absolute power. Nobody must appear covered in its presence, and every person is bound implicitly to execute its commands. As the women know that the visit is intended against some of them, they can have no great relish for the solemnity, but they dare not refuse to attend. The ceremony commences with songs and dances. These continue till midnight, when *Mumbo Jumbo* fixes upon the individual on whose account he comes. She is immediately seized by his command, stripped naked, tied to a post, and scourged with *Mumbo's* rod, to the great entertainment of the whole assembly, and especially of the rest of the women, who are always loudest in their derision and censure of the culprit. The society that conducts the appearance of this mysterious personage make use of a peculiar or cant language, which is not understood by the uninitiated. They pretend that *Mumbo Jumbo* is a wild man, or some strange being that knows every body's thoughts. They bind themselves by oaths never to reveal their secrets to a woman or boy. The fraternity is so powerful, that when one of the Negro kings was weak enough to reveal the secret of *Mumbo Jumbo's* character to a favourite wife, who communicated it to the other females of the household, he and his whole family were immediately assassinated, in the presence, and by the command of *Mumbo Jumbo*; and nobody dared to dispute the propriety of their punishment.

Like all rude nations, the different tribes of Negroes are implicit believers in witchcraft and magic, and in the existence of various kinds of sorcerers. These sorcerers they regard with the utmost terror and abhorrence. They believe that some of them have power to controul the seasons, and to prevent the rice from arriving at maturity. Others of them are supposed to suck

suck the blood of men and beasts, and to occasion all kinds of diseases. When they suspect a person to have died in consequence of sorcery, they interrogate the corpse, which they believe gives answers in the affirmative, by forcibly impelling forward the persons who bear it, and in the negative by a rolling motion. If an answer is given in the affirmative, they inquire concerning the murderer, beginning with the relations of the deceased, and naming the suspected persons. When the guilty person is named, they say that the corpse impels the bearers forward; and upon the authority of this evidence, the person accused is seized and sold into slavery, and sometimes his whole family. It is evident that a trial of this kind may be so managed, as on all occasions to secure the condemnation of the accused person. Accordingly, in proportion to the demand for slaves, accusations of sorcery are more frequently brought forward against their subjects by the Negro chiefs. These accusations, however, are sometimes also brought against persons of importance, who cannot be sold on account of their rank, or against aged persons, whom nobody will purchase. In these cases, the person convicted is compelled to dig his own grave; and being placed at the foot of it, one from behind strikes him a violent blow upon the back of the head or neck, which causes him to fall upon his face into the grave. Some loose earth is then thrown upon him; a stake of hard wood is driven through his body, and the grave is filled up.

Of these and all their other customs, the Negroes are extremely tenacious; and this tenacity of their customs, down to the minutest trifles, forms the principal obstacle to their civilization or improvement. Thus it is the custom to cut the rice six or eight inches below the ear, by two or three stalks at a time, according as they can be grasped between the thumb of the right hand and a knife, which is held in the same hand. The stalks are leisurely transferred to the left hand, and when it is almost full, they are tied like a nosegay and put into a basket. A negro chief who had seen the English mode of reaping, said, that it would cost an African his life, should he attempt to introduce it into his country, as he would be accused of intending to overturn the ancient customs, and would be compelled to drink the red water. By means of their customs, also, property is rendered less valuable than in other countries, which operates as a discouragement to industry. Their agriculture is carried on in concert by the inhabitants of every district, who share in common the products of their harvest. Hence the idea of exclusive property is rendered very vague, while the unlimited exercise of the law or custom of hospitality, renders the possession of it uncertain; as the industrious are forced to share their wealth with the indolent. Begging is not reckoned disgraceful; and if a person has been negligent in providing the necessaries of life, he has only to discover where provisions are to be found, and he must obtain a share; for if he enter a house during a repast, the master, by custom, cannot avoid inviting him to partake. As domestic slavery, however, and the traffic in slaves, constitutes a most profitable branch of the African customs, it is not wonderful that their chiefs adhere to them with peculiar obstinacy.

With regard to the private or domestic economy of

the Negroes, it may be observed, that their houses consist usually of a circular wall, built of mud, or of clay and stone, about four feet high, with a conical roof of bamboos, covered or thatched with hay. As houses of this structure cannot well be divided into separate apartments; where there is a plurality of wives, each has a hut appropriated to herself, and the whole huts belonging to a family are surrounded by a fence of bamboos formed into a kind of wicker work. A number of these enclosures, with intermediate passages or streets, which have no regular arrangement, form a town or village. The furniture of their houses usually consists of a bed, formed of a frame of canes, covered with a bullock's skin or with a mat, and of one or two wooden stools, and a few wooden dishes and pots for dressing food. The dress of both sexes is formed of cotton cloth; that of the men usually consists of a loose shirt or frock with wide sleeves, together with drawers or trowsers, which reach to the middle of the leg. Some of the Negroes add to these a cap and sandals. The dress of the women consists of two pieces of cloth, each of which is about six feet long, and three feet broad. The one is wrapt round the waist and hangs down to the ankles, and the other is negligently thrown over the shoulders.

The state of the women, as among other barbarous nations, is by no means favourable. It is in general accounted altogether unnecessary for a lover to make proposals to his intended bride. She is considered as the property of her father, from whom he purchases her, and to whom he generally pays a price equal to the value of about two slaves. When he has agreed with the parents, therefore, with whom he eats a few nuts to ratify the contract, the proposed bride must give her consent, or remain for ever unmarried; for if she is given to another, the lover is entitled to seize her for a slave. On the day of marriage the bride is conducted with great ceremony to the house of the bridegroom, who must furnish abundance of liquor and refreshments to her attendants. On approaching the house, the bride is covered all over with a robe of white cotton, and is carried on the back of a woman to the house of her husband. She is then placed amidst a circle of matrons, who give her many instructions about her future life. The day is concluded with dances, songs, and feasting, and the validity of the marriage is confirmed by exhibiting tokens of virginity according to the Mosaic law.

A man is allowed to have as many wives as he can afford to purchase, and they are treated in a great measure as slaves, being in general compelled to take the whole charge of the agriculture abroad, as well as of the preparation of food for the family at home. When the husbands, however, are contented with one or two wives, instances of conjugal infidelity are uncommon; but when they have a greater number, they are often under the necessity of overlooking the accidental gallantries of their wives, in consequence of the impossibility of subjecting them to rigid confinement in the simple state of society in which they live. The Negro women suckle their children till they are able to walk, and sometimes till they are three years old, and during that period have no connection with their husbands.

After this account of the Negroes in general, we shall

Africa.
Houses.

Dress.

State of
women.

Marriages.

Polygamy.

Africa.
Particular
tribes.
Mandin-
goes.

shall proceed to take notice of some of the more remarkable tribes into which they are divided, and with which we have been made acquainted by the latest travellers. Of these the tribe of *Mandingoes* is the most important. They derive their name from a district in the interior of Africa, called *Manding*. This territory is situated in the most elevated northern tract of the country of the Negroes, near the sources of the rivers Senegal and Gambia, which flow into the Atlantic on the west, and of the Niger, which proceeds towards the east. Kamaliah, which is one of its towns, and was visited by Mr Park, lies in $12^{\circ} 46'$ N. Lat. Though *Manding* is in so high a level, and abounds in gold, it is not mountainous or barren. The tribe that has issued from it, and assumes the name of *Mandingoes*, forms by far the most numerous race of Negroes through the whole western quarter of the continent of Africa. Their territories intermingle in various situations with the possessions of other states, and they even form the bulk of the population where other tribes enjoy the sovereign power. Their language is by far the most universally understood of all the Negro tongues, and it appears to be more polished than any other. The *Mandingoes* are a tall slender race, of a colour moderately black. Their eyes are remarkably small, and they wear their beards. They are more industrious, and engage more extensively in commerce than the other Negroes, so that they are frequently employed as agents in making bargains by persons of other tribes. In the character of travelling merchants, and instructors of youth, they have insinuated themselves into all the Negro countries, where they are distinguished by wearing more regularly than others a red or white cotton cap, and sandals. Some of them who have learned to read and write Arabic, and who profess Mahometanism, erect schools in the Pagan villages, and instruct the youth gratis. They assume a great appearance of sanctity, abstain from strong liquors, and pretend to the power of counteracting magic. Thus they acquire a most extensive influence, and few affairs of importance are transacted without their advice. In almost every district, troops of *Mandingo* merchants are to be met with; and as their intellectual powers are more developed than those of the other Negroes, they have been able to extend their language, as a kind of learned tongue, second only to the Arabic, along the Senegal and the Niger.

Language
polished,
and exten-
sively
known.

Industrious
as mer-
chants,

and instruc-
tors of
youth.

Courts of
justice.

In most of the *Mandingo* towns there are two public buildings; a mosque for public prayers, and what is called the *bentang*, which is a large stage formed of interwoven bamboos erected under a spreading tree. At the *bentang* all public affairs are transacted, and idle persons assemble to smoke tobacco, and hear news. In every village there is a magistrate, who preserves public order, levies the duties on merchants, and presides at the palavers or courts held by the old men, where justice is administered. At these courts civil questions between parties are debated. In the Pagan states the decisions are pronounced according to the customs of their fathers; but where Mahometanism is more generally received, which is usually the case among the *Mandingoes*, the Koran is the rule of judgement, or the *Sharra*, which contains a digest of Mahometan laws both civil and criminal. Certain Mahometan Negroes, who make the laws of the prophet

their particular study, are frequently retained in causes, as professional pleaders, and they are said to exhibit great dexterity in perplexing the judges.

Africa.

The Pagan *Mandingoes* believe in one God, the creator of all things; but they consider him as of a nature too much exalted above human affairs, to give much attention to their prayers. They address him, however, at the new moons, and imagine every new moon to be a new creation. They fancy that certain subordinate spirits rule the world, and that these spirits are influenced by enchantments and fetiches. They believe in a future state, but most of them admit that they know nothing about it. Their funerals consist of a tumultuous procession, in which they make dismal howlings; and after burying the body beside some large tree, the solemnity terminates in a revel of drinking, and at last of dancing and singing.

Religion.

Next to the *Mandingoes*, the *Foulahs* are the most numerous race of Negroes on the western quarter of the continent of Africa. Their original country is called *Fouladoo*. It is a small state, situated near the sources of the Senegal and the Niger. From thence they have emigrated in powerful clans, and have acquired extensive territories, especially along these rivers, and along the Gambia. The *Foulahs* also possess the sovereignty of various insulated tracts southwards, towards Sierra Leone. Besides the fixed settlements in which they enjoy the sovereignty, they have introduced themselves in many places along the banks of the Gambia, and to the southward along what is called the gulf of Guinea, to a great distance, into the greater part of the Negro states, in the character of shepherds and cultivators of the ground. They obtain admission by paying a tax or rent to the chief of the territory for whatever lands they occupy, and emigrate at pleasure. In consequence of this mode of life, the sovereignty frequently fluctuates in the small states, between them and the *Mandingoes*, and other tribes, according to the proportion of the population, which often alters, from the emigrations of the *Foulahs*.

Foulahs.

The features of the *Foulahs* are very different from those of the other Negroes. They have a Roman nose, a thin face, and small features, with long glossy soft hair, so as to resemble in a great degree the East Indian lascars. Their complexion is by no means of the permanent jetty colour of the other Negroes, but varies with the districts they inhabit, approaching to yellow in the vicinity of the Moors, and deepening into a moderate black towards the equator. Their stature is of the middle size, their form graceful, and their air insinuating. Their women are well shaped, and have regular features; but neither men nor women are so robust in their make as the other Negroes. Hence, they are accounted by the Negroes an intermediate race between themselves and the Moors; but the *Foulahs* consider themselves as superior to the Negroes, and class themselves among white nations. Their natural disposition is mild and humane, and they are extremely hospitable where the Mahometan religion has not taught them to treat infidels with reserve. They support with great care the aged and infirm of their own tribe, and frequently relieve the necessities of persons of other tribes. There are few instances of one *Foulah* being insulted by another, and they never sell their countrymen for slaves; on the contrary, if a

Features.

Character.

Foulah

ca. Foulah have the misfortune to be enslaved, his whole
a. clan or village contributes to pay his ransom.

The Foulahs engage more extensively than the other Negroes in the raising of corn, and the breeding of cattle, but especially in the latter occupation. Hence the Mandingoes frequently entrust their cattle to the care of the Foulahs. They render them tractable by familiarity; feed them by day in the woods and open meadows, and secure them by night in folds, which they fence very strongly. Not satisfied with this precaution, the herdsmen, whose huts are erected in the middle of the fold, keep fires during the night burning around the folds, for the protection of the cattle against wild beasts, and to show that they are in a state of preparation against robbers. From the necessity of guarding their cattle they become intrepid hunters, and kill lions, tigers, elephants, and other wild beasts, with poisoned arrows, or with muskets which they purchase from the whites upon the coast. To poison their arrows, they boil the leaves of a particular shrub in water, and dip in the black juice a cotton thread, which they fasten round the barbs of the arrow.

From the milk of their cattle the Foulahs make considerable quantities of butter; but like all the Negro nations, they are entirely ignorant of the art of preserving milk by making it into cheese. This art is probably prevented from being introduced by the heat of the climate, and by the extreme scarcity of salt, which can be obtained in no other way but by purchasing it from the sea coast, or from caravans of trading Arabs, who bring it on the backs of camels from the great desert. They entertain a singular superstition, that to boil the milk of a cow prevents her from having any more. Hence, they will sell no milk to any person whom they have once discovered to have boiled it.

Like the other Negro tribes, the Foulahs are excessively fond of dancing. They have also a strong passion for music, and their chiefs account a practical skill in it a most respectable accomplishment. Their national airs have a peculiar character, and are tender and pleasing.

Though the Foulahs do not enslave each other, they do not hesitate to make war upon the neighbouring tribes for the purpose of obtaining slaves, chiefly with a view of selling them to the Europeans upon the coast for fire-arms and gunpowder. Such at least is the account of the matter, which was obtained in 1794 by Messrs Watt and Winterburn, who visited Fouta-jallo, an extensive Foulah kingdom in the interior of Sierra Leona. This kingdom extends about 300 miles from east to west, and 200 from north to south. Tembo, the capital, contains 7000 inhabitants. The power of their king is in a great measure arbitrary. On an emergency, he can bring to the field 16,000 cavalry. The markets and all kinds of trade are regulated by him and his officers. The soil is in many places extremely fertile, producing rice and maize, which are cultivated by the women, and carried to market by the men. In general, however, the ground is dry and stony, but affords pasture for all kinds of cattle. Their women dig a species of iron stone from mines of considerable depth. The ore is afterwards manufactured into a very malleable metal. In this kingdom of Fouta-jallo there are schools in every

town; and the majority of the people can read. The Mahometan religion is professed, but the mild character of the Foulahs prevents it from exhibiting that aspect of intolerance towards strangers which characterizes the professors of this religion in other countries.

On the western coast, a great part of the district between the rivers Senegal and Gambia, or, as it is often called, *Senegambia*, is inhabited by a nation called the *Jaloffs*, which differs considerably from the other tribes of the Negroes. Their stature is tall and robust, and, though their complexion is of the deepest black, their noses are not so much depressed, nor their lips so protuberant, as those of the Mandingoes. They excel their neighbours in the manufacture and dyeing of cotton cloth, which they form of a finer thread and a broader web. They use their toes with the same dexterity as their fingers in many operations. Hence when they perceive a pair of scissors, a knife, or a toy which they covet, they turn their backs upon it, and, having engaged the owner in conversation, they seize it artfully with their toes, and throw it into a pouch which they wear behind. In this way, strangers trading in their towns are amazed to find their goods vanishing before their eyes, while they cannot perceive the thief. The *Jaloffs* are very warlike, and equal the Moors in the management of horses; but, as they are divided into a number of petty states, which are continually engaged in war with each other, they have little power as a nation. In the succession to their leaders or chiefs, they follow the female line as the surest; and therefore, the eldest son of the eldest sister of the chief is preferred.

On the coast to the south of the river Gambia, there exists a rude but industrious tribe, called the *Feloots*, who have little intercourse with their neighbours. They possess considerable energy of character, and have resisted successfully the attacks of the Mandingoes, even when assisted by the Portuguese. They are very faithful in friendship, and their enmity is equally permanent, as they transmit their family feuds from generation to generation. When a man is killed in a quarrel, his eldest son procures his sandals, which he wears on the anniversary of the murder of his father, till he can revenge his death. In those parts of their country in which the Europeans have committed any ravages, they give no quarter to a white man. They sell to the Europeans, however, rice, goats, poultry, wax, and honey.

Besides these, a variety of tribes inhabit the same coast, and are known to Europeans under the appellation of *Naloes*, *Biafaras*, *Bissagoes*, *Balantes*, *Papels*, and *Banyans*, of whom it is unnecessary to take particular notice, as they appear to be distinguished by no peculiarity from the other Negro tribes.

Proceeding eastward in the country between the *Bambouk*, Senegal and the Gambia is *Bambouk*, a region of considerable extent. The natives were originally termed *Malinkups*; but, by intermingling with the Mandingoes, they have gradually so much assimilated to that people, as to lose the character of a distinct tribe. The country is mountainous, but is unwholesome and full of minerals. It abounds in mines of gold, silver, copper, tin, and iron, but is neither well suited for gold, &c. agriculture nor for pasturage. The working of the mines is regulated by the caprice or the wants of the chiefs

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chiefs of the different districts. The miners are indolent and unskilful: They never penetrate beyond 10 feet in depth, though the quantity of gold increases with the depth of the mine. They regard gold as a capricious and malevolent being, who delights in deluding the miners; on which account they never attempt to recover a vein when it disappears. The government of Bambouk fluctuates, like that of many of the Negro states, between monarchy and aristocracy, and the power of the king or supreme chief is extremely limited.

The frontiers of the Negro kingdoms usually consist of a wild or desert tract. Thus the kingdom of Woolli, which is on the north-west of Bambouk, is separated on its eastern boundary, by a wilderness filled with wild beasts, from the kingdom of Bondou, which lies to the north of Bambouk. Fattecondi is the capital of Bondou, at which the king resides. The king caused Major Houghton, an English traveller employed by the African Association, to be plundered; and he begged from Mr Mungo Park his blue coat, which that traveller was under the necessity of giving him, to avoid bad usage. His revenues, however, are considerable. His authority is firmly established, and his power is formidable to his neighbours. He was so well pleased with obtaining Mr Park's blue coat, adorned as it was with yellow buttons, that, on the following day he presented to him somewhat more than half an ounce of gold, exempted his baggage from examination by the tax-gatherers, and allowed him to pay a visit to the women of his seraglio. The country at large is covered with wood, and, as it is in an elevated situation, and consequently somewhat less exposed than elsewhere to the burning heat of the climate, it is abundantly fertile. The frontier town of the kingdom eastward is called *Joag*. It contains 2000 inhabitants, is surrounded by a high wall with holes for muskets, and is in $14^{\circ} 25' \text{ N. Lat.}$ and $9^{\circ} 12' \text{ W. Long.}$

To the north-east of Bondou is the Mandingo kingdom of Kasson, in which this peculiar custom or superstition prevails, that no woman is allowed to eat an egg. Kooniakary, the capital, lies in $\text{N. Lat. } 14^{\circ} 31'$, about $59\frac{1}{2}$ geographical miles to the east of Joag. To the south-east of Kasson is the kingdom of Kaarta, which is bordered on the east by Bambara, between which and Kaarta there are very frequent wars; a circumstance which renders travelling through these and other Negro states not a little difficult. The people are industrious: The cultivation of corn is carried on to a great extent, especially in Bambara. They are Mahometans, without the intolerant fanaticism of that religion; and accordingly they are hospitable to strangers, though of a different faith. The neighbourhood of the Moors, however, renders the country unsafe; and, to guard against their incursions, the Negroes, when employed in agriculture, are under the necessity of carrying their arms to the field.

Sego.

Sego, the capital of Bambara, lies in $\text{N. Lat. } 14^{\circ} 10'$, and $\text{W. Long. } 2^{\circ} 26'$; and contains about 30,000 inhabitants. It was here that Mungo Park at last beheld the long-sought majestic river Niger glittering to the morning sun, as broad as the Thames at Westminster, and flowing slowly from west to east. The river is here called the *Joliba* by the natives. From the times of the Nasamonian explorers prior to the days of He-

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rodotus, during 2300 years, no certain intelligence concerning this river had been obtained by the European nations, and its very existence had been doubted by the most intelligent writers. Mr Park is the only European traveller who since that period can boast of having reached it. Sego consists of four distinct towns; two of which are on the north and two on the southern part of the Niger. They are surrounded by high mud walls. The houses are of a square form; they are built of clay, and have flat roofs. The streets are narrow; and, as the Moors form a considerable proportion of the inhabitants, their mosques appear in every quarter. The language, however, is a dialect of the Mandingo. The authority of the Negro king of Bambara is not a little restrained here by the influence of the Moors; and, to avoid giving offence to their intolerant spirit, he was under the necessity of sending Mr Park immediately out of the city to a village in the neighbourhood. The weather was stormy, but some negro women conducted him into a hut, gave him food, and thereafter began to their accustomed labour of spinning cotton. During their work they amused themselves with a song, composed upon the occasion, which one of them sung to a plaintive air. The translation of the song is in these terms: "The wind roared and the rains fell; the poor white man, faint and weary, came and sat under our tree. He has no mother to bring him milk, no wife to grind his corn. *Chorus.* Let us pity the white man, no mother has he," &c.

The current money of this place consists of cowries, a kind of shells (*cyprea moneta* Lin.) which are also employed in the same way in Bengal. A man and his horse can subsist during 24 hours upon the provisions that 100 of them will purchase. The king of Bambara presented Mr Park with 5000 cowries, and desired him to leave the neighbourhood of his capital, that he might not be destroyed by the Moors. This traveller persevered in advancing eastward down the river to another town called *Silla*, situated in $\text{N. Lat. } 14^{\circ} 48'$, Silla. and $\text{W. Long. } 1^{\circ} 24'$, about 1090 British miles east of Cape Verd. This formed the utmost limit to which he was able to advance, and therefore remains the boundary of our certain knowledge of the countries in that direction. He learned, however, that *Silla* stands within 200 miles of the city of Tombuctoo, which is upon the same river, and had long been an object of search of the Portuguese, the French, and English. He was informed, that the country is very populous in that direction. He was also told, that about two days journey below *Silla*, where he stopped, there is a larger town than Sego, called *Jenné*, which stands on a small island in the Niger; and that two days journey below *Jenné*, the river expands into a large lake called *Dibbie*, from which the water issues in two large branches, insulating a fertile and swampy country called *Ginbala*; and that the two great branches of the river reunite at *Kabra*, which is one day's journey to the south of the city of Tombuctoo, of which it is the port. The government of Tombuctoo is said to be in the hands of the Moors; and that place is the principal emporium of the Moorish commerce in Africa. Below Tombuctoo, to the eastward, in the Negro city of Houssa, the capital of a great kingdom, and possessed of extensive commerce. The Niger passes to the south of Houssa at the distance of two days journey; but Mr Park

Africa. Park could learn nothing further concerning its course, as the traders who arrive at Tombuctoo and Houssa from the coast can say nothing more of it, than that *it runs towards the rising of the sun to the end of the world*. Any farther intelligence that has hitherto been obtained, concerning Soudan or Nigritia to the eastward of the route of Mr Park, is extremely uncertain, being merely the result of inquiries made by Mr Horneman among the merchants of Fezzan during his residence there. In the present imperfect state of our knowledge, however, this information is entitled to attention. He observes, that "the Houssa are certainly Negroes, but not quite black; they are the most intelligent people in the interior of Africa; they are distinguished from their neighbours by an interesting countenance; their nose is small and not flattened; and their features are not so disagreeable as those of the Negroes, and they have an extraordinary inclination for pleasure, dancing, and singing. Their character is benevolent and mild. Industry and art, and the cultivation of the natural productions of the land, prevail in their country; and in this respect they excel the Fezzanians, who get the greatest part of their clothes and household implements from the Soudanians. They can dye in this country any colours but scarlet. The culture of their land is as perfect as that of the Europeans, although the same manner of doing it is very troublesome. In short, says Mr Horneman, we have very unjust ideas of this people, not only with respect to their cultivation and natural abilities, but also of their strength and the extent of their possessions, which are by no means so inconsiderable as they have been represented. Their music is imperfect, compared to the European; but the Houssian women have skill enough to affect their husbands thereby even to weeping, and to inflame their courage to the greatest fury against their enemies. The public singers are called *Kadanka*."

ou. The same traveller informs us, that to the eastward of Houssa are situated the dominions of the sultan of Bornou. The people are blacker than the Houssians, and completely Negroes. They are strong, patient of labour, and phlegmatic. Their food is a paste made of flour and flesh, and their liquor is an intoxicating but nourishing kind of beer. Their best natural production is copper. The low country of Wangara is said to be subject to Bornou. It is periodically overflowed by the Niger; but the course of that river farther eastward is not known. Mr Horneman was informed that it had at least a periodical communication with the longer branch of the Nile, called the *Bahr Abiad* or White river, which rises in the mountains Al Komeri, or mountains of the Moon, about the seventh degree of N. Lat. To the eastward of Wangara, at the distance of about six degrees of longitude, is the country of Darfoor already mentioned; beyond which lies Kordafan, another barbarous state; and still farther to the eastward is the country of Abyssinia, in which the shorter branch of the Nile, the *Bahr Azrac* or Blue river, takes its rise, which was visited and traced to its source by our countryman Mr Bruce. That traveller considered the *Bahr Azrac* as the Nile, whereas in truth it is only one of its tributary streams.

The belt or stripe of territory of which we have hitherto taken notice is situated between the 10th and
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Africa. 17th degrees of N. Lat. To the southward of this line the interior of Africa is still unknown, as it has hitherto been visited by no European traveller. We only know that it contains various nations or tribes of Negroes, of different characters and degrees of civilization. It may be observed, however, that to the south of Tombuctoo and Houssa lies the kingdom of Gago, Gago. near a ridge of mountains which run from west to east, and give rise to many streams that flow northward into the Niger. It produces much gold, and the people are warlike. Their armies are composed of cavalry; and no warrior is permitted to take an enemy prisoner before he has obtained, by the mutilation of persons whom he has slain, an hundred bloody trophies, similar to those which, in the Jewish history, David is said to have won from the Philistines and presented to King Saul as the price of his daughter Michal (1 Samuel xviii. 25.) In Gago, when the general takes the field he spreads a buffalo's hide upon the ground; and pitching a spear at each side, he causes the soldiers to march over it till a hole be worn through the hide, when the army is understood to be sufficiently numerous. The king is absolute; but, when they are offended with his conduct, his subjects sometimes rebel and send him a present of parrots eggs, with a message, importing that "his subjects, considering that he must be fatigued with the trouble of government, are of opinion that it is time for him to indulge in a little sleep." If the rebellion appear too formidable to be resisted, his majesty takes the hint, and desires his women to strangle him; upon which he is immediately succeeded by his son.

To the south of Gago, and near to the gulf of Guinea, Dahomy. is the kingdom of Dahomy. The capital, called Abo-my, stands in N. Lat. $7^{\circ} 57'$. The country is fertile and cultivated, bearing every kind of grain, as well as indigo, cotton, and sugar. The character of the people is strongly marked, and some of their customs are singular. In their wars they are bold, and even ferocious; but towards strangers they are hospitable, without any mixture of rudeness. Their king possesses absolute power in the most complete sense of the word. All children, whether male or female, are considered as his property. They are early separated from their parents, and receive a sort of public education, with a view to destroy from their minds all family connections. The king's dwelling occupies a space about a mile square. It consists of a multitude of huts formed of mud walls with bamboo roofs; and the whole is enclosed by a mud wall of 20 feet in height. The entrance of the king's apartment is paved with human skulls, and the side walls are ornamented with the jaw bones of men. On the thatched roofs numerous human skulls are ranged on wooden stakes; and he declares war by announcing that his house wants thatch. He has commonly about 3000 females immured in this dwelling; and about 500 are appropriated to each of the principal officers. When a man wants a wife he must purchase her from the king or some of these officers. He must first lay down the price, which is 20,000 cowries; and must then be contented with the wife that is allotted to him. At his succession the king proclaims that he knows nobody, and is not inclined to make any new acquaintance; that he will administer justice rigorously and impartially, but will listen to no representations against his will; and that he will receive no presents except from his officers, who approach him
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Africa, with the most abject submission. His whole subjects acknowledge themselves his slaves, and admit his right to the absolute disposal of their property and persons. Their character is nevertheless active and intrepid; and they sacrifice themselves in war without hesitation, in obedience to his commands. Thus the Dahomans appear to form a sort of exception to the general mildness of the Negro character.

In addition to what has been here stated concerning the black inhabitants of the southern regions of Africa, it may be remarked, that a French traveller, Vaillant, proceeding northward from the Cape of Good Hope, has made repeated efforts to investigate the character and state of the natives in that quarter. He has extended his researches into what is called the *country of the Caffres*, far beyond the limits that had been reached by any other traveller, and has given us the names of various African tribes, under the appellation of *Gues-siquas*, *Nimiquas*, *Koraquas*, *Kahobiquas*, and *Houzou-anas*. These tribes differ considerably in their features and make of body from the general Negro race, which we have already described. In their moral and intellectual character, however, they are not a little inferior: Their wants are extremely few, and are supplied by their flocks and herds without the necessity of agriculture; and their lives pass away in a routine of listless inactivity, or of simple and uninteresting occupations, the detail of which would afford little amusement or instruction.

European
establish-
ments. -

Slave
trade.

We have already mentioned, that the European nations, during these three last centuries, have established small settlements or garrisons upon different parts of the Negro coast, chiefly for the purpose of obtaining slaves by trading with the natives. The number of people that are annually exported from that country, in consequence of this trade, by Europeans or Moors, is very great. The Europeans have frequently carried from the west coast above 100,000 slaves a year; and the caravans of Egypt and Fezzan carry off about 20,000 annually. The very great extent to which this traffic is carried on the western coast undoubtedly gives rise to many abuses among the native states in that neighbourhood, and is productive of frequent wars among them. Unfortunately, the nations of Europe have hitherto made few efforts to compensate these evils by any attempts to introduce their arts, their civilization, or their science, among the natives. Till lately, the Portuguese were the only nation that attempted the improvement of the Negroes. They did not confine themselves to garrisons or trading factories, but formed considerable colonies on the coasts. They attempted to instruct the natives in the better cultivation of their soil; and introduced their own religion among them. It is even said, that in Loango, Congo, Angola, and Benguela, they have been so sedulous in the conversion of the Negroes, that they have made them better Christians than themselves. It is worthy of notice, as a fact of some importance in natural history, that such of the descendants of the Portuguese in these climates as have adopted the manners of the Negroes, and their modes of life, are hardly to be distinguished in colour from the darkest Negroes. From the weakness of the parent state, the Portuguese settlements, in many places, are greatly decayed; and their efforts for the civilization of the natives have

not been sufficiently extensive or persevering: still, however, they are said to carry on the slave-trade with more mildness and humanity than other nations. The slaves are catechised and baptized before they are shipped; which tends to diminish the terrors attending transportation. The slave-ships of the Portuguese are never crowded, and they are chiefly navigated by black mariners.

In 1779, a Swedish society formed the project of settling a European colony on the western coast of Africa, with the view of disseminating the general principles of civilization. This project was, at a later period, eagerly pressed by Charles Berns Wadstrom, a native of that country, but without success. Afterwards the Danes established a small colony with the same view, near the mouth of the river Volta, under the superintendence of Doctor Isert. In the mean time, the university of Cambridge in England, in 1785, proposed, as the subject of a prize-essay, a question concerning the lawfulness of the slavery and commerce of the human species. The prize was won by Mr J. Clarkson; and the question began to attract public notice: Vast numbers of pamphlets were written; and in a few years the whole nation interested itself in the subject, and the slave-trade became an object of popular indignation. Some legislative attempts were made towards its abolition, which were probably frustrated by the convulsive state into which Europe was plunged by the French revolution. In the mean time, as early as 1783, Doctor H. Smeathman had proposed a specific plan for the colonization of Africa. This plan was not immediately attended to; but in the year 1787, after the subject had assumed a greater degree of importance, an attempt was made to carry it into execution, by sending about four hundred blacks and sixty whites, chiefly people of abandoned characters, collected about London, to Sierra Leona. In consequence of the kind of persons chosen as colonists, this first attempt did not succeed. But in July 1791, a *Sierra Leona* number of persons who had contributed money for the purpose of making a settlement with a view to the instruction and civilization of the Africans, were incorporated by act of parliament under the name of the *Sierra Leona Company*. At the termination of the American war, many black loyalists had been conveyed to Nova Scotia, which they disliked, in consequence of the sterility of the lands allotted to them, and the severity of the climate. The new *Sierra Leona Company* made proposals to these blacks to form a settlement upon the coast of Africa, to which they were to be conveyed at the expence of the Company. The proposal was accepted by 1200 blacks, who arrived at *Sierra Leona* in March 1792. After experiencing considerable difficulties, the colony began to enjoy tolerable prosperity, and received ambassadors from the neighbouring Negro states; but on the 28th September 1794 a French squadron suddenly plundered and destroyed the colonial town. This squadron had been fitted out for the purpose of disturbing the trade of the English slave-factories on the coast, and is said to have been instigated by an American slave captain, who had taken some offence at the governor, to make the attack now mentioned. The damage was repaired. The settlement has since been visited by various missionaries from different religious sects in Britain, with the

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the view of extending the Christian religion. The colony, however, still languishes. It has been engaged in some unfortunate contests with the natives; and it has lately been found necessary to assist the Company with the public money. It seems doubtful how far it is likely ever to fulfil the purpose for which it was instituted, chiefly in consequence of the difficulty of main-

taining a very steady intercourse with the country which founded it, and from the unfavourable nature of the climate to the health of the natives of Europe.

See an account of the latest discoveries in Africa, and a view of the principal questions connected with the geography of that region, under the article AFRICA in the SUPPLEMENT.

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AFRICAN COMPANY. See COMPANY in this work, and AFRICAN COMPANY in the SUPPLEMENT.

AFRICAN Association. See ASSOCIATION.

AFRICAN Institution. See SUPPLEMENT.

AFRICANUS, JULIUS, an excellent historian of the third century, the author of a chronicle which was greatly esteemed, and in which he reckons 5500 years from the creation of the world to Julius Cæsar. This work, of which we have now no more than what is to be found in Eusebius, ended at the 221st year of the vulgar æra. Africanus also wrote a letter to Origen on the history of Susanna, which he reckoned supposititious: and we have still a letter of his to Aristides, in which he reconciles the seeming contradictions in the two genealogies of Christ recorded by St Matthew and St Luke.

AFSLAGERS, persons appointed by the burgo-masters of Amsterdam to preside over the public sales made in that city. They must always have a clerk of the secretary's office with them, to take an account of the sale. They correspond to our brokers, or auctioneers.

AFT, in the sea language, the same with ABAFT.

AFTERBIRTH, in *Midwifery*, signifies the membranes which surround the infant in the womb, generally called the secundines. See MIDWIFERY.

AFTERMATH, in *Husbandry*, signifies the grass which springs or grows up after mowing.

AFTERNOON, the latter half of the artificial day, or that space between noon and night.

AFTER-PAINS, in *Midwifery*, excessive pains felt in the groin, loins, &c. after the woman is delivered.

AFTER-SWARMS, in the management of bees, are those which leave the hive some time after the first has swarmed. See BEE.

AFWESTAD, a large copper-work belonging to the crown of Sweden, which lies on the Dala, in the province of Dalecarlia, in Sweden. It looks like a town, and has its own church. Here they make copper plates; and have a mint for small silver coin, as well as a royal post-house. E. Long. 14. 10. N. Lat. 58. 10.

AGA, in the Turkish language, signifies a great lord or commander. Hence the aga of the janizaries is the commander in chief of that corps; as the general of horse is denominated *spachiclar aga*. The aga of janizaries is an officer of great importance. He is the only person who is allowed to appear before the Grand Signior without his arms across his breast in the posture of a slave. Eunuchs at Constantinople are in possession of most of the principal posts of the seraglio: The title *aga* is given to them all, whether in employment or out. This title is also given to all

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rich men without employ, and especially to wealthy landholders.

We find also *agas* in other countries. The chief officers under the khan of Tartary are called by this name. And among the Algerines, we read of *agas* chosen from among the *boluk bashis* (the first rank of military officers), and sent to govern in the chief towns and garrisons of that state. The *aga* of Algiers is the president of the divan, or senate. For some years, the *aga* was the supreme officer; and governed the state in place of the bashaw, whose power dwindled to a shadow. But the soldiery rising against the *boluk bashis*, or *agas*, massacred most of them, and transferred the sovereign power to the caliph, with the title of *Dey* or King.

AGADES, a kingdom and city of Negroland in Africa. It lies nearly under the tropic of Cancer, between Gubur and Cano. The town stands on a river that falls into the Niger; it is walled, and the king's palace is in the midst of it. The king has a retinue, who serve as a guard. The inhabitants are not so black as other Negroes, and consist of merchants and artificers. Those that inhabit the fields are shepherds or herdsmen, whose cottages are made of boughs, and are carried about from place to place on the backs of oxen. They are fixed on the spot of ground where they intend to feed their cattle. The houses in the city are stately, and built after the Barbary fashion. This kingdom was, and may be still, tributary to the king of Tombuctoo. It is well watered; and there is great plenty of grass, cattle, senna, and manna. The prevailing religion is the Mahometan, but it is not rigidly practised. N. Lat. 26. 10. E. Long. 9. 10.

AGALLOCHUM, a very fragrant medicinal wood brought from the East Indies. See EXCÆCARIA, BOTANY Index.

AGALMATA, in antiquity, a term originally used to signify any kind of ornaments in a temple; but afterwards for the statues only, which were most conspicuous.

AGAMEMNON, the son of Atreus by Erope, was captain general of the Trojan expedition. It was foretold to him by Cassandra, that his wife Clytemnestra would be his death: yet he returned to her; and accordingly was slain by Ægisthus, who had gained upon his wife in his absence, and by her means got the government into his own hands.

AGAN, in *Geography*, one of the Ladrone islands. The circumnavigator, Magellan, was assassinated here in the year 1525.

AGANIPPE, in antiquity, a fountain of Bœotia, at Mount Helicon, on the borders between Phocis and Bœotia, sacred to the Muses, and running into the river Permessus; (Pliny, Pausanias.) Ovid seems to make

Aganippe
||
Agard.

Aganippe and *Hippocrene* the same. Serenus more truly distinguishes them, and ascribes the blending them to poetical license.

AGANIPPIDES, in ancient poetry, a designation given to the Muses, from a fountain of Mount Helicon, called *Aganippe*.

AGAPE, in ecclesiastical history, the love-feast, or feast of charity, in use among the primitive Christians; when a liberal contribution was made by the rich to feed the poor. The word is Greek, and signifies *love*. St Chrysostom gives the following account of this feast, which he derives from the apostolical practice. He says, "The first Christians had all things in common, as we read in the Acts of the Apostles; but when that equality of possessions ceased, as it did even in the Apostles time, the *agape*, or love-feast, was substituted in the room of it. Upon certain days, after partaking of the Lord's supper, they met at a common feast; the rich bringing provisions, and the poor who had nothing being invited." It was always attended with receiving the holy sacrament; but there is some difference between the ancient and modern interpreters as to the circumstance of time, viz. whether this feast was held before or after the communion. St Chrysostom is of the latter opinion; the learned Dr Cave of the former.—These love-feasts, during the three first centuries, were held in the church without scandal or offence; but, in after times, the heathens began to tax them with impurity. This gave occasion to a reformation of these *agapæ*. The kiss of charity, with which the ceremony used to end, was no longer given between different sexes; and it was expressly forbidden to have any beds or couches, for the convenience of those who should be disposed to eat more at their ease. Notwithstanding these precautions, the abuses committed in them became so notorious, that the holding of them (in churches at least) was solemnly condemned, at the council of Carthage, in the year 307.

AGAPETÆ, in ecclesiastical history, a name given to certain virgins and widows, who, in the ancient church associated themselves with, and attended on, ecclesiastics, out of a motive of piety and charity.

In the primitive days there were women instituted **DEACONESSES**; who, devoting themselves to the service of the church, took up their abode with the ministers, and assisted them in their functions. In the fervour of the primitive piety, there was nothing scandalous in these societies: but they afterwards degenerated into libertinism; inasmuch, that St Jerome asks, with indignation, *unde agapetarum pestis in ecclesias introiit?* This gave occasion for councils to suppress them.—St Athanasius mentions a priest, named Leontius, who, to remove all occasion of suspicion, offered to mutilate himself, to preserve his beloved companion.

AGARD, ARTHUR, a learned English antiquarian, born at Toston in Derbyshire in the year 1540. His fondness for English antiquities induced him to make many large collections; and his office as deputy chamberlain of the exchequer, which he held 45 years, gave him great opportunities of acquiring skill in that study. Similarity of taste brought him acquainted with Sir Robert Cotton and other learned men, who associated themselves under the name of *The Society of Antiquarians*, of which society Mr Agard was a conspicuous member. He made the *Doomsday book* his peculiar

study; and composed a work purposely to explain it, under the title of *Tractatus de usu et obscurioribus verbis libri de Domesday*: he also compiled a book for the service of his successors in office, which he deposited with the officers of the king's receipt, as a proper index for succeeding officers. All the rest of his collections, containing at least twenty volumes, he bequeathed to Sir Robert Cotton; and died in 1615.

AGARIC, FEMALE. See **BOLETUS**, **BOTANY Index**.

AGARIC Mineral, a marly earth resembling the vegetable of that name in colour and texture. It is found in the fissures of rocks, and on the roofs of caverns; and is sometimes used as an astringent in fluxes, hemorrhagies, &c.

AGARICUS, MUSHROOM. See **AGARICUS**, **BOTANY Index**.

AGATE, or **ACHAT**, (among the Greeks and Latins, *Αχατης* and *Achates*, from a river in Sicily, on the banks of which it was first found), a very extensive genus of the semipellucid gems.

These stones are variegated with veins and clouds, but have no zones like those of the onyx. They are composed of crystal debased by a large quantity of earth, and not formed, either by repeated incrustations round a central nucleus, or made up of plates laid evenly on one another; but are merely the effect of one simple concretion, and variegated only by the disposition given by the fluid they were formed in to their differently coloured veins or matters.

Agates are arranged according to the different colours of their ground. Of those with a *white* ground there are three species. (1.) The *dendrachates*, *mocosa stone*, or *arborescent agate*. This seems to be the same with what some authors call the *achates* with rosemary in the middle, and others *achates* with little branches of black leaves. (2.) The *dull milky-looking agate*. This, though greatly inferior to the former, is yet a very beautiful stone. It is common on the shores of rivers in the East Indies, and also in Germany and some other parts of Europe. Our lapidaries cut it into counters for card-playing, and other toys of small value. (3.) The *lead-coloured agate*, called the *phassachates* by the ancients.

Of the agates with a *reddish* ground there are four species. (1.) An impure one of a flesh-coloured white, which is but of little beauty in comparison with other agates. The admixture of flesh-colour is but very slight; and it is often found without any clouds, veins, or other variegations; but sometimes it is prettily veined or variegated with spots of irregular figures, having fimbriated edges. It is found in Germany, Italy, and some other parts of Europe; and is wrought into toys of small value, and often into the German gunflints. It has been sometimes found with evident specimens of the perfect mosses bedded deep in it. (2.) That of a pure blood colour, called *hemachates*, or the *bloody agate*, by the ancients. (3.) The clouded and spotted agate, of a pale flesh colour, called by the ancients the *carnelian achates* or *sardachates*. (4.) The red-lead coloured one, variegated with yellow, called the *coral agate*, or *coralla-achates*, by the ancients.

Of the agates with a *yellowish* ground there are only two known species; the one of the colour of yellow wax, called *cerachates* by the ancients; the other a very

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Agate.

gate. very elegant stone, of a yellow ground, variegated with white, black, and green, called the *leonina*, and *leonteseres*, by the ancients.

Lastly, Of the agates with a *greenish* ground, there is only one known species, called by the ancients *jaspachates*.

Of all these species there are a great many varieties; some of them having upon them natural representations of men and different kinds of animals, &c. Those representations are not confined to the agates whose ground is of any particular colour, but are occasionally found on all the different species. Velschius had in his custody a flesh-coloured agate, on one side of which appeared a half moon in great perfection, represented by a milky semicircle; on the other side, the phases of *vesper*, or the evening star: whence he denominated it an *aphrodisian agate*. An agate is mentioned by Kircher*, on which was the representation of a heroine armed; and one in the church of St Mark in Venice has the representation of a king's head adorned with a diadem. On another, in the museum of the prince of Gonzaga, was represented the body of a man with all his clothes in a running posture. A still more curious one is mentioned by De Boot†, wherein appears a circle struck in brown, as exactly as if done with a pair of compasses, and in the middle of the circle the exact figure of a bishop with a mitre on: but inverting the stone a little, another figure appears; and if it is turned yet further, two others appear, the one of a man, and the other of a woman. But the most celebrated agate of this kind is that of Pyrrhus, wherein were represented the nine Muses, with their proper attributes, and Apollo in the middle playing on the harp‡. In the emperor's cabinet is an oriental agate of a surprising bigness, being fashioned into a cup, whose diameter is an ell, abating two inches. In the cavity is found delineated in black specks, B. KRISTOR. S. XXX. Other agates have also been found, representing the numbers 4191, 191; whence they were called *arithmetical* agates, as those representing men or women have obtained the name of *anthropomorphous*.

Great medicinal qualities were formerly attributed to the agate, such as resisting poisons, especially those of the viper, scorpion, and spider; but they are now very justly rejected from medicinal practice. The oriental ones are all said to be brought from the river Gambay. A mine of agates was some time ago discovered in Transylvania, of divers colours; and some of a large size, weighing several pounds.

Agates may be stained artificially with solution of silver in spirit of nitre, and afterwards exposing the part to the sun; and though these artificial colours disappear on laying the stone for a night in aquafortis, yet a knowledge of the practicability of thus staining agates, must render these curious figures above mentioned strongly suspected of being the work not of nature but of art. Some account for these phenomena from natural causes. Thus Kircher, who had seen a stone of this kind in which were depicted the four letters usually inscribed on crucifixes, I. N. R. I. apprehends that some real crucifix had been buried under ground, among stones and other rubbish, where the inscription happening to be parted from the cross, and to be received among a soft mould or clay susceptible of the impression of the letters, came afterwards to be

petrified. In the same manner he supposes the agate of Pyrrhus to have been formed. Others resolve much of the wonder into fancy, and suppose those stones formed in the same manner with the *camaïeux** or Florentine stones. * See *Camaïeux*.

The agate is used for making cups, rings, seals, handles for knives and forks, hilts for swords and hangers, beads to pray with, smelling boxes, patch-boxes, &c. being cut or sawed with no great difficulty. At Paris none have a right to deal in this commodity except the wholesale mercers and goldsmiths. The sword cutlers are allowed to sell it, but only when made into handles for *couteaux de chasse*, and ready set in. The cutlers have the same privilege for their knives and forks.

Considerable quantities of these stones are still found near the river Achatas in Sicily. There are found in some of these the surprising representations above mentioned, or others similar to them. By a dexterous management of these natural stains, medals have been produced, which seem masterpieces of nature: for this stone bears the graver well; and as pieces of all magnitudes are found, they make all sorts of work of it. The high altar of the cathedral of Messina is all over encrusted with it. The lapidaries pretend that the Indian agates are finer than the Sicilian; but Father Labat† informs us, that in the same quarries, and even in the same block, there are found pieces much finer than others, and these fine pieces are sold for Indian agates in order to enhance their prices. † *Voyage d'Italie*, tom. i. p. 136.

AGATE, among *antiquaries*, denotes a stone of this kind engraven by art. In this sense, agates make a species of antique gems; in the workmanship whereof we find eminent proofs of the great skill and dexterity of the sculptors. Several agates of exquisite beauty are preserved in the cabinets of the curious; but the facts or histories represented on these antique agates, however well executed, are now become so obscure, and their explications so difficult, that several diverting mistakes and disputes have arisen among those who undertook to give their true meaning.

The great agate of the apotheosis of Augustus, in the treasury of the holy chapel, when sent from Constantinople to St Lewis, passed for a triumph of Joseph. An agate, which was in the French king's cabinet‡, had been kept 700 years with great devotion, in the Benedictine abbey of St Evre at Toul, where it passed for St John the Evangelist carried away by an eagle, and crowned by an angel; but the Heathenism of it having been lately detected, the religious would no longer give it a place among their relics, but presented it in 1684 to the king. The antiquaries found it to be the apotheosis of Germanicus. In like manner the triumph of Joseph was found to be a representation of Germanicus and Agrippina, under the figures of Ceres and Triptolemus. Another was preserved, from time immemorial, in one of the most ancient churches of France, where it had passed for a representation of paradise and the fall of man; there being found on it two figures representing Adam and Eve, with a tree, a serpent, and a Hebrew inscription round it, taken from the third chapter of Genesis, "The woman saw that the tree was good," &c. The French academists, instead of our first parents, found Jupiter and Minerva represented by the two figures: the inscription was of

Agate.

* See *Camaïeux*.† *Voyage d'Italie*, tom. i. p. 136.‡ *Hist. Acad. R. Inscript.* tom. i. p. 337, 344.

Agate
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Agde.

a modern date, written in a rabbinical character, very incorrect, and poorly engraven. The prevailing opinion was, that this agate represented simply the worship of Jupiter and Minerva at Athens.

AGATE is also the name of an instrument used by gold-wire drawers; so called from the agate in the middle of it, which forms its principal part.

AGATHIAS, or, as he calls himself in his epigrams, AGATHIUS, distinguished by the title of *Scholasticus*, a Greek historian in the 6th century under Justinian. He was born at Myrina, a colony of the ancient Æolians, in Asia the Less, at the mouth of the river Phythicus. He was an advocate at Smyrna. Though he had a taste for poetry, he was yet more famous for his history, which begins with the 26th year of Justinian's reign, where Procopius ends. It was printed in Greek and Latin by Vulcanius, at Leyden, 1594, in 4to; and at Paris at the king's printing house, 1660, in folio.

AGATHO, the Athenian, a tragic and comic poet, was the disciple of Prodicus and Socrates, and applauded by Plato in his Dialogues for his virtue and beauty. His first tragedy obtained the prize; and he was crowned in the presence of upwards of 30,000 persons in the 4th year of the 90th Olympiad. There is nothing now extant of his works, excepting a few quotations, in Aristotle, Athenæus, and others.

AGATHOCLES, the famous tyrant of Sicily, was the son of a potter at Reggio. He was a thief, a common soldier, a centurion, a general, and a pirate, all in regular succession. He defeated the Carthaginians several times in Sicily, and was once defeated himself. He first made himself tyrant of Syracuse, and then of all Sicily; after which he vanquished the Carthaginians again both in Sicily and Africa. But at length having ill success, and being in arrears with his soldiers, they mutinied, forced him to fly his camp, and cut the throats of his children, whom he left behind. Recovering himself again, he relieved Corfu, besieged by Cassander; burnt the Macedonian fleet; returned to Sicily; murdered the wives and children of those who had murdered his: afterwards meeting with the soldiers themselves, he put them all to the sword; and, ravaging the sea-coast of Italy, took the city of Hipponium. He was at length poisoned by his grandson Archagathus, in the 72d year of his age, 290 years before Christ, having reigned 28 years.

AGATHYRNA, or AGATHYRNUM, AGATHYRSA, or AGATHYRSUM, in *Ancient Geography*, a town of Sicily; now *St Marco*; as old as the war of Troy, being built by Agathyrnus, son of Æolus, on an eminence. The gentilitious name is *Agathyrnæus*; or, according to the Roman idiom, *Agathyrnensis*.

AGAVE, AMERICAN ALOE, in *Botany*. See BOTANY *Index*.

AGDE, a city of France, in the department of Herault, formerly the province of Languedoc, in the territory of Agadez, with a bishop's see. The diocese is small, but is one of the richest countries in the kingdom. It produces fine wool, wine, oil, corn, and silk. It is seated on the river Herault, a mile and a quarter from its mouth, where it falls into the gulf of Lyons, and where there is a fort built to guard its entrance. It contains 7200 inhabitants; the houses are built of black stone, and there is an entrance into the city by

four gates. The greatest part of the inhabitants are merchants or seamen. The public buildings are but mean: the cathedral is small, and not very handsome: the bishop's palace is an old building, but convenient. The city is extended along the river, where it forms a little port wherein small craft may enter. There is a great concourse of pilgrims and other devout people to the chapel of Notre Dame de Grace. It is a little without the city, between which and the chapel there are about thirteen or fourteen oratories, which they visit with naked feet. The convent of the Capuchins is well built, and on the outside are lodgings and apartments for the pilgrims who come to perform their *neuvaine* or nine days devotion. The chapel, which contains the image of the Virgin Mary, is distinct from the convent. E. Long. 3. 28. N. Lat. 43. 19.

AGE, in the most general sense of the word, signifies the duration of any being, from its first coming into existence to the time of speaking of it, if it still continues; or to its destruction, if it has ceased to exist some time before we happen to mention it.

Among the ancient poets, this word was used for the space of 30 years; in which sense, *age* amounts to much the same with *generation*. Thus, Nestor is said to have lived *three ages* when he was 90 years old.—By ancient Greek historians, the time elapsed since the beginning of the world is divided into three periods, which they called *ages*. The first reaches from the creation to the deluge which happened in Greece during the reign of Ogyges; this they called the *obscure* or *uncertain* age, because the history of mankind is altogether uncertain during that period. The second they call the *fabulous* or *heroic* age, because it is the period in which the fabulous exploits of their gods and heroes are said to have been performed. It began with the Ogygian deluge, and continued to the first Olympiad; where the third or *historical* age commenced.—This division however, it must be observed, holds good only with regard to the Greeks and Romans, who had no histories earlier than the first Olympiad; the Jews, Egyptians, Phœnicians, and Chaldees, not to mention the Indians and Chinese, who pretend to much higher antiquity, are not included in it.

The interval since the first formation of man has been divided by the poets into four *ages*, distinguished by the epithets of *golden*, *silver*, *brazen*, and *iron*. During the *golden* age, Saturn reigned in heaven, and justice and innocence in this lower world. The earth then yielded her productions without culture; men held all things in common, and lived in perfect friendship. This period is supposed to have lasted till the expulsion of Saturn from his kingdom. The *silver* age commenced when men began to deviate from the paths of virtue: and, in consequence of this deviation, their lives became less happy. The *brazen* age commenced on a farther deviation, and the *iron* age took place in consequence of one still greater. A late author, however, reflecting on the barbarism of the first ages, will have the order which the poets assign to the four ages inverted; the first being a time of rudeness and ignorance, more properly denominated an *iron* than a *golden* age. When cities and states were founded, the *silver* age commenced; and since arts and sciences, navigation and commerce, have been cultivated, the *golden* age has taken place.

Adge.
Age.

In some ancient northern monuments, the *rocky* or *stony* age corresponds to the *brazen* age of the Greeks. It is called *rocky*, on account of Noah's ark, which rested on Mount Ararat; whence men were said to be descended or sprung from mountains: or from Deucalion and Pyrrha restoring the race of mankind, by throwing stones over their heads. The northern poets also style the fourth age of the world the *ashen* age, from a Gothic king Madenis, or Mannus, who on account of his great strength was said to be made of ash, or because in his time people began to make use of weapons made of that wood.

Among the Jews, the duration of the world is also divided into three ages. 1. The *seculum inane*, or *void age*, was the space of time from the creation to Moses. 2. The *present age*, denotes all the space of time from Moses to the coming of the Messiah; and, 3. The *age to come*, denotes the time from the coming of the Messiah to the end of the world.

Various other divisions of the duration of the world into *ages* have been made by historians.—The Sibylline oracles, wrote according to some, by Jews acquainted with the prophecies of the Old Testament, divide the duration of the world into ten *ages*; and according to Josephus, each age contained six hundred years. It appears, by Virgil's fourth eclogue, and other testimonies, that the age of Augustus was reputed the end of those ten *ages*, consequently as the period of the world's duration.

By some, the space of time commencing from Constantine, and ending with the taking of Constantinople by the Turks in the 15th century, is called the *middle age*: but others choose rather to date the middle age from the division of the empire made by Theodosius at the close of the 4th century, and extend it to the time of the emperor Maximilian I. in the beginning of the 16th century, when the empire was first divided into circles.—The *middle* is by some denoted the *barbarous* age, and the latter part of it the *lowest* age. Some divide it into the *non-academical* and *academical* ages. The first includes the space of time from the 6th to the 9th century, during which schools or academies were lost in Europe. The second from the 9th century, when schools were restored, and universities established, chiefly by the care of Charlemagne.

The several *ages* of the world may be reduced to three grand epochs, viz. the *age* of the law of nature, called by the Jews the *void age*, from Adam to Moses; the *age* of the Jewish law, from Moses to Christ; and the *age* of grace, from Christ to the present year.

AGE is also frequently used in the same sense with *century*, to denominate a duration of 100 years.

AGE likewise signifies a certain period of the duration of human life; by some divided into four stages, namely, infancy, youth, manhood, and old age; the first extending to the 15th year, the second to the 25th, the third to the 50th, and the fourth to the end of life; by others divided into infancy, childhood, youth, manhood, and old age.

AGE, in *Law*, signifies a certain period of life, when persons of both sexes are enabled to do certain acts. Thus, one at twelve years of age ought to take the oaths of allegiance to the king in a leet; at fourteen he may marry, choose his guardian, and claim his lands held in soccage. Twenty-one is called *full age*, a man

or woman being then capable of acting for themselves, of managing their affairs, making contracts, disposing of their estates, and the like.

AGE of a Horse. See HORSE.

AGE of Trees. These after a certain age waste. An oak at a hundred years old ceases to grow. The usual rule for judging of the age of wood, is by the number of circles which appear in the substance of a trunk or stock cut perpendicularly, each circle being supposed the growth of a year; though some reject this method as precarious, alleging, that a simple circle is sometimes the produce of several years; besides that, after a certain age, no new circles are formed.

AGE-Prior, in *Law*, is when an action being brought against a person under age, for lands descended to him, he, by motion or petition, shows the matter to the court, praying the action may be staid till his full age, which the court generally agrees to.

AGELNOTH, EGELNOTH, or ÆTHELNOTH, in Latin *Achelnotus*, archbishop of Canterbury, in the reign of Canute the Great, succeeded Livingus in that see in the year 1020. This prelate, surnamed the *Good*, was son of Earl Agilmer, and at the time of his election, dean of Canterbury. After his promotion he went to Rome, and received his pall from Pope Benedict VIII. In his way thither, as he passed through Pavia, he purchased, for an hundred talents of silver and one of gold, St Augustin's arm, which was kept there as a relic; and sent it over to England as a present to Leofric earl of Coventry. Upon his return, he is said to have raised the see of Canterbury to its former lustre. He was much in favour with King Canute, and employed his interest with that monarch to good purposes. It was by his advice the king sent over large sums of money for the support of the foreign churches; and Malmesbury observes that this prince was prompted to acts of piety, and restrained from excesses, by the regard he had for the archbishop. Agelnoth, after he had sat 17 years in the see of Canterbury, departed this life on the 29th of October 1038, and was succeeded by Eadsin, King Harold's chaplain. This archbishop was an author, having written, 1. A Panegyric on the blessed Virgin Mary. 2. A Letter to Earl Leofric concerning St Augustin. 3. Letters to several persons.

AGEMA, in Macedonian antiquity, was a body of soldiers, not unlike the Roman legion.

AGEMOGLANS, AGIAMOGLANS, or AZAMOGGLANS, in the *Turkish Polity*, are children purchased from the Tartars, or raised every third year, by way of tribute, from the Christians tolerated in the Turkish empire. These, after being circumcised and instructed in the religion and language of their tyrannical masters, are taught the exercises of war, till they are of a proper age for carrying arms; and from this corps the janizaries are recruited. With regard to those who are thought unfit for the army, they are employed in the lowest offices of the seraglio. Their appointments also are very small, not exceeding seven aspers and a half per day, which amount to about threepence-halfpenny of our money.

AGEN, a city of France, on the river Garonne, the capital of Agenois, in the province of Guienne, now the department of the Lot and Garonne, and the see of a bishop. The gates and old walls, which are yet remaining,

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Agentes.

remaining, show that this city is very ancient, and that its former circuit was not so great as the present. The palace, wherein the presidial holds his sessions at this day, was heretofore called the castle of Montravel, and is seated without the walls of the old city, and on the side of the fossé. There are likewise the ruins of another castle, called *La Sagne*, which was without the walls, close by a brook. Though the situation of Agen is convenient for trade and commerce, but very little use is made of this advantage. Its population was 10,834 by the last enumeration. It is seated on the bank of the river Garonne, in a pleasant country; but is itself a very mean and disagreeable place, the houses being ill-built, and the streets narrow, crooked, and dirty. E. Long. 0. 35. N. Lat. 44. 12.

AGENDA, among philosophers and divines, signifies the duties which a man lies under an obligation to perform: thus we meet with the *agenda* of a Christian, or the duties he ought to perform; in opposition to the *credenda*, or things he is to believe.

AGENDA, among merchants, a term sometimes used for a memorandum-book, in which is set down all the business to be transacted during the day, either at home or abroad.

AGENDA, among ecclesiastical writers, denotes the service or office of the church. We meet with *agenda matutina et vespertina*, "the morning and evening prayers;" *agenda diei*, "the office of the day," whether feast or fast; *agenda mortuorum*, called also simply *agenda*, "the service of the dead."

AGENDA is also applied to certain church-books, compiled by public authority, prescribing the order and manner to be observed by the ministers and people in the principal ceremonies and devotions of the church. In which sense *agenda* amounts to the same with what is otherwise called *ritual*, *liturgy*, *acalouthia*, *missal*, *formulary*, *directory*, &c.

AGENHINE, in our old writers, signifies a guest that has lodged at an inn for three nights, after which time he was accounted one of the family; and if he offended the king's peace, his host was answerable for him. It is also written HOGENHINE and HOGENHYNE.

AGENOIS, in *Geography*, a country of France, in the department of the Garonne, formerly the province of Guienne. It contains about one hundred and twenty square leagues; is fertile and healthy; and, according to Cæsar, was inhabited by the Nitiobriges. It constituted part of the kingdom of Aquitania; was held by the counts of Toulouse, and successively by the English and French.

AGENORIA, in mythology, the goddess of courage and industry, as *Vacuna* was of indolence.

AGENT, in a general sense, denotes any active power or cause. Agents are either natural or moral. Natural agents are such inanimate bodies as have a power to act upon other bodies in a certain and determinate manner; as gravity, fire, &c. Moral agents, on the contrary, are rational creatures, capable of regulating their actions by a certain rule.

AGENT, is also used to denote a person intrusted with the management of an affair, whether belonging to a society, company, or private person.

AGENTES *in rebus*, one of the ranks of officers in the court of the Constantinopolitan emperors, whose busi-

ness was to collect and convey the corn both for the army and household; to carry letters and messages from court to all parts of the empire; to regulate couriers and their vehicles; to make frequent journeys and expeditions through the provinces, in order to inspect any motions, disturbances, or machinations tending that way, and to give early notice thereof to the emperor.

The *agentes in rebus* are by some made synonymous with our post-masters, but their functions were of great extent. They correspond to what the Greeks call *πυροφοροι*, and the Latins *veredarii*.

There were various orders or degrees of *agentes in rebus*; as *tribuni*, *primicerii*, *senatores*, *ducenarii*, *biarchi*, *circitores*, *equites*, *tyrones*, &c. through all which they rose *gradatim*. Their chief, who resided at Constantinople, was denominated *princeps*; which was a post of great dignity, being reckoned on a level with that of proconsul. They were settled in every part of the empire; and are also said to have served as interpreters.

AGER, in Roman antiquity, a certain portion of land allowed to each citizen. See AGRARIAN LAW.

AGER PICENUS, or *Picenum*, in *Ancient Geography*, a territory of Italy to the south-east of Umbria, reaching from the Apennines to the Adriatic. The people are called *Picentes* (Cicero, Livy,) distinct from the Picentini on the Tuscan sea, though called by Greek writers *Πικετινι*. This name is said to be derived from the bird *picus*, under whose conduct they removed from the Sabines, of whom they were a colony.

AGERATUM, BASTARD HEMP-AGRIMONY, in *Botany*. See BOTANY *Index*.

AGESILAUS, king of the Lacedæmonians, the son of Archidamus, was raised to the throne in opposition to the superior claim of his nephew Leotychides. As soon as he came to the throne, he advised the Lacedæmonians to anticipate the king of Persia, who was making great preparations for war, and to attack him in his own dominions. He was himself chosen for this expedition; and gained so many advantages over the enemy, that if the league which the Athenians and the Thebans formed against the Lacedæmonians had not obliged him to return home, he would have carried his victorious arms into the very heart of the Persian empire. He gave up, however, all these triumphs readily, to come to the succour of his country, which he happily relieved by his victory over the allies in Bæotia. He obtained another near Corinth; but to his great mortification, the Thebans afterward gained several over the Lacedæmonians. These misfortunes at first raised a clamour against him. He had been sick during the first advantages which the enemy gained; but as soon as he was able to act in person, his valour and prudence prevented the Thebans from reaping the advantages of their victories; so that it was generally believed, had he been in health at the beginning, the Lacedæmonians would have sustained no losses, and that all would have been lost had it not been for his assistance. It cannot be denied but he loved war more than the interest of his country required; for if he could have lived in peace, he had saved the Lacedæmonians several losses, and they would not have been engaged in many enterprises which in the end contributed much to weaken their power. He died in the third

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Agēsilaus

third year of the 104th Olympiad, being the 84th year of his age, and 41st of his reign, and was succeeded by his son Archidamus. Agesilaus would never suffer any picture or sculpture to be made of him, and prohibited it also by his will: this he is supposed to have done from a consciousness of his own deformity; for he was of a short stature, and lame of one foot, so that strangers used to despise him at the first sight. His fame went before him into Egypt, and there they had formed the highest ideas of Agesilaus. When he landed in that country, the people ran in crowds to see him: but great was their surprise when they saw an ill-dressed, slovenly, mean-looking little fellow, lying upon the grass: they could not forbear laughing, and applied to him the fable of the mountain in labour. He was, however, the first to jest upon his own person; and such was the gaiety of his temper, and the strength with which he bore the roughest exercises, that these qualities made amends for his corporeal defects. He was remarkable for plainness and frugality in his dress and mode of life. "This (says Cornelius Nepos) is especially to be admired in Agesilaus: when very great presents were sent him by kings, governors, and states, he never brought any of them to his own house; he changed nothing of the diet, nothing of the apparel of the Lacedæmonians. He was contented with the same house in which Euristhenes, the founder of his family, had lived: and whoever entered there, could see no sign of debauchery, none of luxury; but on the contrary, many of moderation and abstinence; for it was furnished in such a manner, that it differed in nothing from that of any poor or private person." Upon his arrival in Egypt, all kinds of provisions were sent to him; but he chose only the most common, leaving the perfumes, the confections, and all that was esteemed most delicious, to his servants. Agesilaus was extremely fond of his children, and would often amuse himself by joining in their diversions: one day when he was surprised riding upon a stick with them, he said to a person who had seen him in this posture, "Forbear talking of it till you are a father."

AGGA, or AGGONNA, a British settlement on the Gold coast of Guinea. It is situated under the meridian of London, in 6 degrees of N. Lat.

AGGER, in the ancient military art, a work of fortification, used both for the defence and the attack of towns, camps, &c. In which sense it is the same with what was otherwise called *vallum*, and in later times *aggestum*; and among the moderns *lines*, sometimes, *cavaliers*, *terrasses*, &c. The agger was usually a bank, or elevation of earth or other matter, bound and supported with timber; having sometimes turrets on the top, wherein the workmen, engineers, and soldiery, were placed. It was also accompanied with a ditch, which served as its chief defence. The usual materials of which it was made were earth, boughs, fascines, stakes, and even trunks of trees, ropes, &c. variously crossed, and interwoven somewhat in the figure of stars; whence they were called *stellati axes*. When these were wanting, stones, bricks, tiles, supplied the office: on some occasions arms, utensils, pack-saddles, were thrown in to fill it up. We even read of aggers formed of the carcasses of the slain; sometimes of dead bones mixed with lime; and even with the heads of slaughtered citizens. For want of due binding, or so-

lid materials, aggers have sometimes tumbled down, with infinite mischief to the men. The besiegers used to carry on a work of this kind nearer and nearer towards the place, till at length they reached the very wall. The methods taken on the other side to defeat them were, by fire, especially if the agger were of wood; by sapping and undermining, if of earth; and in some cases, by erecting a counter agger.

The height of the agger was frequently equal to that of the wall of the place. Cæsar tells us of one he made, which was 30 feet high and 330 feet broad. Besides the use of aggers before towns, the generals used to fortify their camps with such works; for want of this precaution, armies have often been surprised and ruined.

There were vast aggers made in towns and places on the sea-side, fortified with towers, castles, &c. Those made by Cæsar and Pompey at Brundisium, are famous. Sometimes aggers were even built across arms of the sea, lakes, and morasses; as was done by Alexander before Tyre, and by M. Antony and Cassius.—The wall of Severus, in the north of England, may be considered as a grand agger, to which belong several lesser ones.

AGGER, in ancient writers; likewise denotes the middle part of a military road, raised into a ridge, with a gentle slope on either side, to make a drain for the water, and keep the way dry.

The term is also used for the whole road, or military way. Where highways were to be made in low grounds, as between two hills, the Romans used to raise them above the adjacent land, so as to make them of a level with the hills. These banks they called *aggeres*. Bergher mentions several in Gallia Belgica, which were thus raised, ten, fifteen, or twenty feet above ground.—They are sometimes also called *aggeres calceati*; and now generally known by the name *chausses* or *causeways*.

AGGERHUYS, a city of Norway, capital of the province of the same name, subject to Denmark, and situated in E. Long. 28. 35. N. Lat. 59. 30.

AGGERS-HERRED, a district of Christiansand, and a diocese of Norway. It consists of three juridical places: namely, Ascher, West Barm, and Agger.

AGGLUTINANTS, in *Pharmacy*, a general name for all medicines of a glutinous or viscid nature; which, by adhering to the solids, were supposed to contribute to repair their loss.

AGGLUTINATION, in a general sense, denotes the joining two or more things together, by means of proper glue or cement.

AGGLUTINATION, among physicians, implies the action of reuniting the parts of a body, separated by a wound, cut, &c. It is also applied to the action of such internal medicines as are supposed to be of an agglutinating quality.

AGGREGATE, in a general sense, denotes the sum of several things added together, or the collection of them into one whole. Thus a house is an aggregate of stones, wood, mortar, &c. It differs from mixed or compound; for, in the latter, the union is more intimate than between the parts of an aggregate.

AGGREGATE, in *Botany*, is a term used to express those flowers which are composed of parts or florets, so united, by means either of the receptacle or calyx, that

Agger
Aggregate.

Aggrega-
tion
||
Agincourt.

that no one of them can be taken away without destroying the form of the whole. They are opposed to simple flowers, which have no such common part. See *BOTANY Index*.

AGGREGATION, in physics, a species of union, whereby several things which have no natural dependence or connexion with one another are collected together, so as in some sense to constitute one. Thus, a heap of sand, or a mass of ruins, are bodies by aggregation.

AGHER, a town of Ireland, situated in the southern part of Ulster, not far from Clogher.

AGHRIM, a town of Ireland, in the county of Wicklow, and province of Leinster, situated about 31 miles south-west of Wicklow.

AGHRIM, in Galway; a small village, distant about 32 miles from Dublin, and rendered memorable by a decisive battle fought there, and at Kilcommodon-hill, the 12th of July 1691, between General Ginkle and Monsieur St Ruth, the commanders under King William III. and James II.; when St Ruth, the general of the Irish army, with 7000 of his men, was slain; but of the English only 600. The victory was the more considerable, as the English army consisted of no more than 18,000 men; whereas the Irish were computed at 20,000 foot, and 5000 horse and dragoons. They lost likewise nine pieces of brass cannon; all their ammunition, tents, and baggage; and most of their small arms, which they threw away to expedite their flight; with 11 standards, and 32 pair of colours.

AGIADES, in the Turkish armies, a kind of pioneers employed in fortifying camps, smoothing of roads, and the like offices.

AGILITY, an aptitude of the several parts of the body to motion. The improving of agility was one of the chief objects of the institution of games and exercises. The *athletæ* made particular profession of the science of cultivating and improving agility. Agility of body is often supposed peculiar to some people; yet it seems less owing to any thing peculiar in their frame and structure than to practice.

AGINCOURT, a village of the French Netherlands, situated in E. Long. 2. 10. N. Lat. 50. 35.; famous on account of the victory obtained by Henry V. of England over the French, in 1415.

The army of Henry, after landing in France, was by various accidents reduced to 10,000 men, of whom not a few were sick, or slowly recovering from sickness;—they had to traverse a long tract of country, inhabited by exasperated enemies, from whom they were to procure provisions, lodging, guides, intelligence, and every thing they wanted;—that country was defended by many strong towns, intersected by deep rivers, and guarded by an army of 100,000 or (according to some contemporary writers) 140,000 men.

Henry, undaunted by all these dangers and difficulties, departed from Harfleur, marching his army in three lines, with bodies of cavalry on the wings. He proceeded by very easy journeys, that he might not fatigue his troops, or discourage them by the appearance of a flight; observing the strictest discipline, and paying generously for every thing he received; which induced the country people to bring provisions to his camp, in spite of all the commands they had received to the contrary. To keep his men in spirits, and from

repining, the king fared as ill as the meanest soldier, always appearing with a cheerful countenance, and addressing them in the most friendly and encouraging language. They arrived at the village of Agincourt in the county of St Pol, on the evening of October 24th; and there beheld the whole French army, at a small distance, directly in their route. The king took an attentive view of it from an eminence: and being fully convinced that it was impossible to proceed any further on his way to Calais without a battle, and equally impossible to return to Harfleur with so great an army in his rear, resolved to hazard an action next morning, as the only means of preserving himself and his little army from destruction.

The English army lodged that night in the villages of Agincourt, Maisencelle, and some others; where they met with better accommodation than they had been accustomed to for some time past, and spent part of their time in mutual exhortations to fight bravely in the approaching battle. The king, overhearing some of his nobles expressing a wish, that the many brave men who were idle in England were present to assist them, is said to have cried out—"No! I would not have one man more:—if we are defeated, we are too many—if it shall please God to give us the victory, as I trust he will, the smaller our number the greater our glory." The moon happening to shine very bright, Henry, with some of his best officers, carefully examined the ground, and pitched upon a field of battle, admirably calculated to preserve a small army from being surrounded by a great one. It was a gentle declivity from the village of Agincourt, of sufficient extent for his small army, defended on either side by hedges, trees, and brush-wood. Having placed guards and kindled fires on all sides, the king and his army betook themselves to rest; except such as were of a more serious turn of mind, who, considering that as the last night of their lives, spent it in devotion.

The French exulting in their numbers, confident of victory, and abounding in provisions, spent the night in noisy festivity, and in forming fanciful schemes about the disposal of their prisoners and their booty. It was in general resolved to put all the English to the sword, except the king and the chief nobility, who were to be taken prisoners for the sake of their ransoms.

On the morning of Friday the memorable 25th of October, A. D. 1415, the day of Crispin and Crispianus, the English and French armies were ranged in order of battle, each in three lines, with bodies of cavalry on each wing. The constable d'Albert, who commanded the French army, fell into the snare that was laid for him, by drawing up his army in the narrow plain between the two woods. This deprived him, in a great measure, of the advantage he should have derived from the prodigious superiority of his numbers; obliged him to make his lines unnecessarily deep, about 30 men in file; to crowd his troops, particularly his cavalry, so close together, that they could hardly move or use their arms; and, in a word, was the chief cause of all the disasters that followed. The French, it is said, had a considerable number of cannon of different sizes in the field; but we do not hear that they did any execution, probably for want of room. The first line of the French army, which consisted of 8000 men at arms

Agincourt. at arms on foot mixed with 4000 archers, with 500 men-at-arms mounted on each wing, was commanded by the constable d'Albert, the dukes of Orleans and Bourbon, and many other nobles; the dukes of Alençon, Brabant, and Bar, &c. conducted the second line; and the earls of Marle, Damartine, Fauconberg, &c. were at the head of the third line. The king of England employed various arts to supply his defect of numbers. He placed 200 of his best archers in ambush, in a low meadow, on the flank of the first line of the French. His own first line consisted wholly of archers, four in file; each of whom, besides his bow and arrows, had a battle-axe, a sword, and a stake pointed with iron at both ends, which he fixed before him in the ground, the point inclining outwards, to protect him from cavalry. This was a new invention, and had a happy effect. That he might not be encumbered, he dismissed all his prisoners, on their word of honour to surrender themselves at Calais, if he obtained the victory; and lodged all his baggage in the village of Agincourt, in his rear, under a slender guard. The command of the first line was, at his earnest request, committed to Edward duke of York, assisted by the Lords Beaumont, Willoughby, and Fanhope; the second was conducted by the king, with his youngest brother Humphry duke of Gloucester, the earls of Oxford, Marshal, and Suffolk; and the third was led by the duke of Exeter, the king's uncle. The lines being formed, the king, in shining armour, with a crown of gold adorned with precious stones on his helmet, mounted on a fine white horse, rode along them, and addressed each corps with a cheerful countenance and animating speeches. To inflame their resentment against their enemies, he told them, that the French had determined to cut off three fingers of the right hand of every prisoner: and to rouse their love of honour, he declared, that every soldier in that army who behaved well, should from henceforth be deemed a gentleman, and entitled to bear coat armour.

When the two armies were drawn up in this manner, they stood a considerable time gazing at one another in solemn silence. But the king, dreading that the French would discover the danger of their situation and decline a battle, commanded the charge to be sounded, about ten o'clock in the forenoon. At that instant, the first line of the English knelt down, and kissed the ground; and then starting up, discharged a flight of arrows, which did great execution among the crowded ranks of the French. Immediately after, upon a signal being given, the archers in ambush arose, and discharged their arrows on the flank of the French line, and threw it into some disorder. The battle now became general, and raged with uncommon fury. The English archers, having expended all their arrows, threw away their bows, and, rushing forward, made dreadful havock with their swords and battle-axes. The first line of the enemy was, by these means, defeated; its leaders being either killed or taken prisoners. The second line, commanded by the duke d'Alençon, (who had made a vow either to kill or take the king of England, or to perish in the attempt), now advanced to the charge, and was encountered by the second line of the English, conducted by the king. This conflict was more close and furious than the former. The duke of Gloucester, wounded and unhorsed,

was protected by his royal brother till he was carried off the field. The duke d'Alençon forced his way to the king, and assaulted him with great fury; but that prince brought him to the ground, where he was instantly dispatched. Discouraged by this disaster, the second line made no more resistance; and the third fled without striking a blow; yielding a complete and glorious victory to the English, after a violent struggle of three hours duration.

The king did not permit his men to pursue the fugitives to a great distance, but encouraged them to take as many prisoners as they could on or near the field; in which they were so successful, that, in a little time, his captives were more numerous than his soldiers. A great proportion of these prisoners were men of rank and fortune; for many of the French noblesse being on foot, and loaded with their heavy armour, could not make their escape. Among these were the dukes of Orleans and Bourbon, the marshal Boucicaut, the counts d'Eu, Vendome, Richemont, and Harcourt; and 7000 barons, knights, and gentlemen. The French left dead on the field of battle, the constable d'Albert, the three dukes of Alençon, Brabant, and Bar, the archbishop of Sens, one marshal, 13 earls, 92 barons, 1500 knights, and a far greater number of gentlemen, besides several thousands of common soldiers. Even the French historians acknowledge, that the loss of the English was inconsiderable: those of our own cotemporary writers who make it the greatest, affirm, that it did not exceed 100, and that the duke of York and the earl of Suffolk were the only great men who fell on that side in this memorable action.

AGIO, in commerce, is a term chiefly used in Holland, and at Venice, to signify the difference between the value of bank stock and the current coin. The agio in Holland is generally three or four per cent. and at Rome it is from 15 to 25 per cent.; but at Venice the agio is fixed at 20 per cent.

AGIOSYMANDRUM, a wooden instrument used by the Greek and other churches under the dominion of the Turks, to call together assemblies of the people. The *agiosymandrum* was introduced in the place of bells, which the Turks prohibited their Christian subjects the use of, lest they should make them subservient to sedition.

AGIS, king of Lacedæmon, was descended from Agesilaus II. in a right line. He projected the reformation of his kingdom, by the restoring of the laws of Lycurgus: but he fell under the weight of an enterprise that could not but be disagreeable to all those who had great possessions, and had been long accustomed to the sweets of a voluptuous life. Agis being in the flower of his age, and having a very refined desire of glory, practised the ancient discipline first in his own person: his clothes and his table were according to the manners of former times; which is so much the more to be admired, because Agesistrata his mother and Archidamia his grandmother had brought him up voluptuously. When he sounded the people's minds, he found the younger sort opposed his project less than those who had enjoyed a relaxation of discipline several years. The greatest difficulty was expected to arise from the women. They had at that time more credit than ever; for their power is never greater than when luxury is in fashion. Agesilaus's mother did not at all

Agincourt
Agis.

Agis.

relish the proposed reformation. She must have lost her riches, which gave her a share in a thousand sorts of intrigues; so she opposed the design at once, and treated it as a chimera. But her brother Agesilaus, whom Agis had engaged in his interests, knew how to manage her in such a manner, that she promised to second the enterprise. She endeavoured to gain the women: but instead of suffering themselves to be persuaded, they applied to Leonidas the other king of Lacedæmon, and humbly besought him to frustrate the designs of his colleague. Leonidas durst not oppose it openly, for fear of irritating the people; to whom the reformation was agreeable, because they found their account in it. He contented himself with countermining it by intrigues, and sowing suspicions as if Agis had aspired to tyranny, by pulling down the rich and raising the poor. Agis did not fail to propose his new laws to the senate, relating to the discharge of debts, and a new division of the lands. Leonidas, being supported by the rich, opposed this project so strongly, that there was one voice more against it than for it. He paid dear for his success in this affair. Lysander, one of the Ephori, who had been the grand promoter of the reformation; called him to account; alleged the celestial signs; and put to death Cleombrotus, a prince of the royal blood and son-in-law to Leonidas, to make sure of the kingdom. Leonidas being frightened at this, took refuge in a temple; whither his daughter, the wife of Cleombrotus, followed him. He was summoned; and because he did not appear, he was degraded of his dignity, which was conferred on Cleombrotus. He obtained leave to retire to Tegæa. The new Ephori had Lysander and Mandroclidas tried for innovation: these persuaded the two kings to unite and turn out these Ephori. The thing was brought about; but not without a great uproar in the city. Agesilaus, one of the Ephori that succeeded those that were just turned out, would have caused Leonidas to be killed on the way to Tegæa, if Agis had not sent him a strong guard. The reformation might then have been established, if Agesilaus had not found means to elude the good intentions of the two kings. Whilst this was transacting, the Achæians asked assistance; which was given them, and Agis had the command of the troops. He acquired a good deal of reputation in this campaign. At his return, he found his affairs so embroiled by the ill conduct of Agesilaus, that it was impossible for him to maintain himself. Leonidas was recalled to Lacedæmon: Agis retired into one temple and Cleomenes into another. The wife of the latter behaved herself in such a manner that she became the admiration of every body. Leonidas was contented with banishing his son-in-law; after which he applied himself entirely to the ruin of Agis. One of the Ephori, who had no mind to return what Agesistrata had lent him, was the principal instrument of the misfortune of this family. Agis never went out of his sanctuary but to bathe. One day, as he was returning from thence to the temple, he was seized by that Ephorus and carried to prison. Then he was brought to his trial and condemned to death, and delivered to the executioner. His mother and grandmother used all the intreaty and importunity imaginable, that, as he was king of Lacedæmon, he might at least be permit-

ted to plead his cause before the people. But they were apprehensive lest his words would make too great an impression, and therefore they ordered him to be strangled that very hour. The Ephorus who was in debt to Agesistrata permitted that princess to go into the prison; which he granted likewise to Agis's grandmother: but he gave orders to strangle them one after another. Agesistrata died in a manner that was extremely to her honour. The wife of Agis, who was a princess of great fortune and prudence, and one of the finest ladies in Greece, was forced away from her apartment by King Leonidas, and obliged to marry his son, who was then very young, and hardly fit for marriage.

AGISTMENT, **AGISTAGE**, or **AGISTATION**, in *Law*, the taking in other people's cattle to graze at so much per week. The term is peculiarly used for the taking cattle to feed in the king's forests, as well as for the profits arising from that practice.—It is also used, in a metaphorical sense, for any tax, burden, or charge; thus, the tax levied for repairing the banks of Romney-marsh was called *agistamentum*.

AGISTOR, or **AGISTATOR**, an officer belonging to forests, who has the care of cattle taken in to be grazed, and levies the moneys due on that account. They are generally called *quest-takers* or *gift-takers*, and are created by letters-patent. Each royal forest has four agistors.

AGISYMBIA, in *Ancient Geography*, a district of Libya Interior, according to Agathemerus, situated to the south-east of the Æthiopes Anthropophagi; the parallel passing through which, at 16° to the south of the equator, was the utmost extent of the knowledge of the ancients to the south (Ptolemy).

AGITATION, the act of shaking a body, or tossing it backwards and forwards.

AGITATION, in *Physic*, is often used for an intestine commotion of the parts of a natural body. Fermentation and effervescence are attended with a brisk agitation of the particles.

AGITATION is one of the chief causes or instruments of mixtion: by the agitation of the parts of the blood and chyle, in their continual circulation, sanguification is in a good measure effected. Butter is made out of milk by the same means: in which operation, a separation is made of the oleous parts from the serous, and a conjunction of the oleous together. Digestion itself is only supposed to be an insensible kind of agitation.

AGITATION is reputed one of the symptoms of inspiration. Petit informs us*, that in the last century, * *Petit* there arose in a church of Italy, for the space of a year, *Sibylla*, a vapour of an extraordinary kind, which put all the l. 1. No people into trembling and agitations, and unless they *Rep. L.* got away betimes, set them a dancing, with strange *tom. vii* contortions and gesticulations. This seems to verify *p. 1113* what has been related of the temple of Delphi.

AGITATION is also used in *Medicine* for a species of exercise popularly called *swinging*. Maurice prince of Orange found this method a relief against the severe pains of the gout and stone. Bartholine mentions fits of the toothach, deafness, &c. removed by vehement agitations of the body.

AGITATOR, in antiquity, a term sometimes used for a charioteer, especially those who drove in the circus at the curule games.

AGITATORS,

Agis
||
Agitato

AGITATORS, in the English history, certain officers set up in the army in 1647, to take care of its interests. —Cromwell joined the agitators, only with a view to serve his own ends; which being once accomplished, he found means to get them abolished.

AGLAIA, the name of the youngest of the three Graces, espoused to Vulcan.

AGLIONBY, JOHN, an English divine, chaplain in ordinary to King James I. was born in Cumberland, and admitted a student at Oxford in 1583. He was a man of universal learning, and had a very considerable hand in the translation of the New Testament appointed by King James I. in 1604. He died in 1609.

AGMEN, in antiquity, properly denotes a Roman army in march: in which sense, it stands contradistinguished from *acies*, which denoted the army in battle array; though, on some occasions, we find the two words used indifferently for each other. The Roman armies, in their marches, were divided into *primum agmen*, answering to our van-guard; *medium agmen*, our main-guard; and *postremum agmen*, the rear-guard. The order of their march was thus: After the first signal with the trumpets, &c. the tents were taken down, and the baggage packed up; at the second signal, the baggage was to be loaded on the horses and carriages; and, at the third signal, they were to begin their march. First came the *extraordinarii*; then the auxiliaries of the first wing, with their baggage; these were followed by the legions. The cavalry marched either on each side or behind.

AGNATE, in *Law*, any male relation by the father's side.

AGNEL, an ancient French gold coin, first struck under the reign of St Louis, worth about twelve sols six deniers. The agnel is also called sometimes *mouton d'or*, and *agnel d'or*. The denomination is supposed to have arisen from the figure of a lamb (*agnus*) or sheep, struck on one side.

AGNES, SAINT, in *Geography*, one of the Scilly isles, on the west of England, which is of small extent, but well cultivated, and fertile in corn and grass. On the most elevated part of the island stands the lighthouse, built of stone, which is 51 feet high. The whole inhabitants consist of about 50 families. It is situated in N. Lat. 49. 56. W. Long. 6. 46.

AGNESI, MARIA GAETANA, an Italian lady celebrated for her skill in mathematics. See SUPPLEMENT.

AGNO, a river of Naples, which taking its rise in the mountains of Terra di Lavoro, falls into the Mediterranean, about seven miles north of Puzzuoli.

AGNOETÆ (from *agnosco*, to be ignorant of), in church history, a sect of ancient heretics, who maintained that Christ, considered as to his human nature, was ignorant of certain things, and particularly of the time of the day of judgment. Eulogius, patriarch of Alexandria, ascribes this heresy to certain solitaries in the neighbourhood of Jerusalem, who built their opinion upon the text Mark xiii. 32. "Of that day and hour knoweth no man, no not the angels who are in heaven, neither the Son, but the Father only."—The same passage was made use of by the Arians; and hence the orthodox divines of those days were induced to give various explications thereof. Some allege, that our Saviour here had no regard to his divine nature, but only spoke of his human. Others understand it

thus, That the knowledge of the day of judgment does not concern our Saviour considered in his quality of Messiah, but God only; which is the most natural solution.

AGNOMEN, in Roman antiquity, a kind of fourth or honorary name, given to a person on account of some extraordinary action, virtue, or other accomplishment. Thus the agnomen *Africanus* was bestowed upon Publius Cornelius Scipio, on account of his great achievements in Africa.—The agnomen was the third in order of the three Roman names: thus, in Marcus Tullius Cicero, Marcus is the prænomen, Tullius the nomen, and Cicero the agnomen.

AGNUS, or **LAMB**, in *Zoology*, the young of the ovine or sheep. See **OVIS**.

AGNUS Castus, in *Botany*, the trivial name of a species of the vitex. See **VITEX**, *BOTANY Index*. The Greeks call it *αγνος*, *chaste*; to which has since been added the reduplicative *castus*, q. d. chaste, chaste. It was famous among the ancients as a specific for the preservation of chastity. The Athenian ladies, who made profession of chastity, lay upon leaves of *agnus castus* during the feasts of Ceres.—From the time of Dioscorides the seeds of *agnus castus* have been much celebrated for their antiaphrodisiac virtue. Modern writers ascribe to them an opposite effect; but they are seldom used in practice.

AGNUS Dei, in the church of Rome, a cake of wax stamped with the figure of a lamb supporting the banner of the cross. These being consecrated by the pope with great solemnity, and distributed among the people, are supposed to have great virtues; as, to preserve those who carry them worthily, and with faith, from all manner of accidents; to expel evil spirits, &c. The name literally signifies *Lamb of God*: this being supposed an image or representation of the Lamb of God who took away the sins of the world. They cover it up with a piece of stuff cut in form of a heart, and carry it very devoutly in their processions.—The Romish priests and religious derive considerable pecuniary advantage from selling these *Agnus Dei's* to some, and presenting them to others. The pope provides a regular supply, by consecrating once in seven years: they are distributed by the master of the wardrobe, and received by the cardinals and other prelates, with great reverence, in their caps and mitres.—This ceremony they pretend to derive from an ancient custom of the church, wherein part of the paschal taper consecrated on Holy Thursday was distributed among the people, to perfume their houses, fields, &c. in order to drive away devils, and to preserve them from storms and tempests. The *Agnus Dei* is forbidden to be brought into England under pain of incurring a *premunire*; 13 Eliz. cap. 2.

AGNUS Dei is also a popular name for that part of the mass wherein the priest, striking his breast three times, rehearses, with a loud voice, a prayer beginning with the words *Agnus Dei*.—It is said to have been first brought into the missal by Pope Sergius I.

AGOGE, among ancient musicians, a species of modulation, wherein the notes proceed by continuous degrees.

AGON, among the ancients, implied any dispute or contest, whether it had regard to bodily exercises or the accomplishments of the mind; and therefore poets, musicians,

Agnoetæ
||
Agon.

Agon
||
Agony.

musicians, painters, &c. had their agones, as well as the athletæ. Games of this kind were celebrated at most of the heathen festivals with great solemnity, either annually, or at certain periods of years. Among the latter were celebrated at Athens, the *agon gymnicus*, the *agon Nemeus* instituted by the Argives in the 53d Olympiad, and the *agon Olympius* instituted by Hercules 430 years before the first Olympiad.—The Romans also, in imitation of the Greeks, instituted contests of this kind. The emperor Aurelian established one under the name of *agon solis*, the contest of the sun; Dioclesian another, which he called *agon capitolinus*, which was celebrated every fourth year, after the manner of the Olympic games. Hence the years, instead of *lustra*, are sometimes numbered by *agones*.

AGON also signified one of the ministers employed in the heathen sacrifices, and whose business it was to strike the victim. The name is supposed to have been derived from hence, that standing ready to give the stroke, he asked, *Agon'?* or *Agone?* Shall I strike.

AGONALES, an epithet given to the SALII.

AGONALIA, in Roman antiquity, festivals celebrated in honour of Janus or the god Agonius, whom the Romans invoked before undertaking any affair of importance.

AGONALIS CIRCUS, now *La Piazza Navona*, a long, large, beautiful street in the heart of Rome, adorned with fountains, and the obelisk of Caracalla, still retaining the form of that circus. The reason of the name *Agonalis* is either unknown or doubtful. Ovid seems to derive it from the *agones*, or solemn games, there celebrated; supposed to have been the *Ludi Apollinares*, or *Actiaci*, instituted by Augustus; whence the circus was called *Apollinaris*; also *Alexandrinus*, from the emperor Alexander Severus, who either enclosed or repaired it.

AGONISMA, in antiquity, denotes the prize given to the victor in any combat or dispute.

AGONISTARCHA, from *αγων*, “combat,” and *αρχος*, “chief,” in antiquity, seems to have been much the same with *agonotheta*; though some suggest a difference, making it the office of the former to preside at and direct the private exercises of the athletæ, which they went through by way of practice, before they made their appearance on the public theatres or amphitheatres.

AGONISTICI, in church history, a name given by Donatus to such of his disciples as he sent to fairs, markets, and other public places, to propagate his doctrine; for which reason they were also called *Circitores*, *Circelliones*, *Catropitæ*, *Coropitæ*, and at Rome *Montenses*. They were called *Agonistici*, from the Greek *αγων*, “combat,” in regard they were sent as it were to fight and subdue the people to their opinions.

AGONIUM, in Roman antiquity, was used for the day on which the *rex sacrorum* sacrificed a victim, as well as for the place where the games were celebrated, otherwise called *agon*.

AGONOTHETA, or AGONOTHETES, in Grecian antiquity, was the president or superintendant of the sacred games; who not only defrayed the expence attending them, but inspected the manners and discipline of the athletæ, and adjudged the prizes to the victors.

AGONY, any extreme pain. It is also used for

the pangs of death. Much of the terror of death consists in the pangs and convulsions wherewith the agony seems attended; though we have reason to believe that the pain in such cases is ordinarily not extremely acute; a course of pain and sickness having usually stupified and indisposed the nerves for any quick sensations. However, various means have been thought of for mitigating the agony of death. Lord Bacon considers this as part of the province of a physician; and that not only where such a mitigation may tend to a recovery, but also when, there being no further hope of a recovery, it can only tend to make the passage out of life more calm and easy. Complacency in death, which Augustus so much desired, is certainly no small part of happiness. Accordingly, the author last cited ranks *euthanasia*, or the art of dying easily, among the desiderata of science; and does not even seem to disapprove of the course Epicurus took for that end,

—*Hinc stygias ebrius hausit aquas.*

Opium has been applied for this purpose, with the applause of some, but the condemnation of more.

AGONYCLITÆ, or AGONYCLITES, in church history, a sect of Christians, in the 7th century, who prayed always standing, as thinking it unlawful to kneel.

AGORÆUS, in heathen antiquity, an appellation given to such deities as had statues in the market-places; particularly Mercury, whose statue was to be seen in almost every public place.

AGORANOMUS, in Grecian antiquity, a magistrate of Athens, who had the regulation of weights and measures, the prices of provisions, &c.—The *agoranomi*, at Athens, were ten in number, five belonging to the city, and as many to the Piræus; though others make them 15 in all, of whom they assign 10 to the city. To these a certain toll or tribute was paid by all who brought any thing to sell in the market.

AGOUTI, or AGUTI. See MUS.

AGRA, a large city in Hindostan on the river Jumna, and capital of a province of the same name. The houses consist of several stories, and the streets are so narrow as scarcely to admit a palanqueen. The greatest part of it is now a heap of ruins, and nearly uninhabited. On the opposite side of the river are several handsome tombs. The Taje Mahal, perhaps the most superb mausoleum in the world, is situated about three miles below the city, and is constructed of white marble inlaid with precious stones. It was built by the emperor Shah Jehan between the years 1631 and 1640, for the cemetery of his wife, and is said to have cost 750,000l. sterling. Agra was taken from the Moguls in 1784 by Madajee Sindia the Mahratta chief, and remained in the hands of his successor till 1803, when it was captured by the British army under Lord Lake. E. Long. 76. 56. N. Lat. 27. 12.

AGRARIAN LAWS, among the Romans, those relating to the division and distribution of lands; of which there were a great number; but that called the *Agrarian Law*, by way of eminence, was published by Spurius Cassius, about the year of Rome 268, for dividing the conquered lands equally among all the citizens, and limiting the number of acres which each citizen might enjoy.—The Roman lands were of several kinds; some conquered from the enemies, and not yet brought to the public account; others brought in-

Agon
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Agrarii

deed to the public, but clandestinely usurped by private great men; lastly, others purchased with the public money, in order to be divided. Agrarian laws, either for dividing lands taken from the enemy, or the public lands, or those purchased with the public money, were easily passed without disturbance; but those whereby private rich men were to be deprived of their lands, and the common people put in possession of what had been held by the nobility, were never attempted without great disturbances.

Several have pleaded for the necessity of agrarian laws among us: but no author has entered so deeply into the subject as Mr Harrington in his *Oceana*; which the reader may consult.

AGREDA, a town of Spain, in Old Castile, near the frontiers of Arragon, and about three leagues south-west of Tاراcon.

AGRIA, called by the Germans *Eger*, is a strong town in Upper Hungary, containing 8000 inhabitants, and is a bishop's see. It is situated on a river of the same name, and has a citadel called *Eriaw*. It was besieged by the Turks in 1552, with 70,000 men: but they lost 8000 in one day, and were obliged to raise the siege, though the garrison consisted only of 2000 Hungarians, assisted by the women, who performed wonders on this occasion. However, it was afterwards taken by Mahomet III. in 1596; but was retaken by the emperor in 1687: since which time it has continued under the dominion of the house of Austria. It is 47 miles north-east of Buda, and 55 south-west of Cassovia. E. Long. 20. 10. N. Lat. 48. 10.

AGRICOLA, CNEUS JULIUS, born at Frejus, in Provence, was, in Vespasian's time, made lieutenant to Vettius Bolanus in Britain; and upon his return, was ranked by that emperor among the patricians, and made governor of Aquitania. This post he held three years; and upon his return was chosen consul, and afterward appointed governor of Britain, where he greatly distinguished himself. He reformed many abuses occasioned by the avarice or negligence of former governors, put a stop to extortion, and caused justice to be impartially administered. Vespasian dying about this time, his son Titus, knowing the great merit of Agricola, continued him in the government. In the spring he marched towards the north, where he made some new conquests, and ordered forts to be built for the Romans to winter in. He spent the following winter in concerting schemes to bring the Britons to conform to the Roman customs. He thought the best way of diverting them from rising and taking arms, was to soften their rough manners, by proposing to them new kinds of pleasure, and inspiring them with a desire of imitating the Roman manners. Soon after this, the country was adorned with magnificent temples, porticoes, baths, and many other fine buildings. The British nobles had at length their sons educated in learning; and they who before had the utmost aversion to the Roman language, now began to study it with great assiduity: they were likewise the Roman habit; and, as Tacitus observes, they were brought to consider those things as marks of politeness, which were only so many badges of slavery. Agricola, in his third campaign, advanced as far as the Tweed; and in his fourth, he subdued the nations betwixt the Tweed and the friths of Edinburgh and Clyde, into which the rivers Clotta

and Bodotria discharge themselves; and here he built fortresses to shut up the nations yet unconquered. In his fifth, he marched beyond the friths; where he made some new acquisitions, and fixed garrisons along the western coasts, over against Ireland. In his sixth campaign he passed the river Bodotria; ordering his fleet, the first which the Romans ever had in those parts, to row along the coasts, and take a view of the northern parts. In the following spring, the Britons raised an army of 30,000 men; and the command was given to Galgacus, who, according to Tacitus, made an excellent speech to his countrymen on this occasion. Agricola likewise addressed his men in very strong and eloquent terms. The Romans gained the victory, and 10,000 of the Britons are said to have been killed. This happened in the reign of the emperor Domitian; who, growing jealous of the glory of Agricola, recalled him, under pretence of making him governor of Syria. Agricola died soon after; and his death is suspected to have been occasioned by poison given him by that emperor. Tacitus the historian married his daughter, wrote his life, and laments his death in the most pathetic manner.

AGRICOLA, George, a German physician, famous for his skill in metals. He was born at Glaucha, in Misnia, the 24th of March 1494. The discoveries which he made in the mountains of Bohemia, gave him so great a desire of examining accurately into every thing relating to metals, that though he had engaged in the practice of physic at Joachimstal by advice of his friends, he still prosecuted his study of fossils with great assiduity; and at length removed to Chemnitz, where he entirely devoted himself to this study. He spent in pursuit of it the pension he had of Maurice duke of Saxony, and part of his own estate; so that he reaped more reputation than profit from his labours. He wrote several pieces upon this and other subjects; and died at Chemnitz the 21st of November 1555, a very firm Papist. In his younger years he seemed not averse to the Protestant doctrine; and he highly disapproved of the scandalous traffic of indulgences, and several other things in the church of Rome. The following lines of his were posted up in the streets of Zwickaw, in the year 1519:

*Si nos injecta salvebit cistula nummo,
Heu nimium infelix tu mihi, pauper, eris!
Si nos, Christe, tua servatos morte bedsti,
Tum nihil infelix es mihi, pauper, eris.*

If wealth alone salvation can procure,
How sad a state for ever waits the poor!
But if thou, Christ, our only saviour be,
Thy merits still may bless ev'n poverty!

In the latter part of his life, however, he had attacked the Protestant religion: which rendered him so odious to the Lutherans, that they suffered his body to remain unburied for five days together; so that it was obliged to be removed from Chemnitz to Zeits, where it was interred in the principal church.

AGRICOLA, John, a Saxon divine, born at Eisleben in 1492. He went as chaplain to Count Mansfeld, when that nobleman attended the elector of Saxony to the diet at Spire in 1526, and that of Augsburg in 1530. He was of a restless, ambitious temper, rivalled and

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¹ Agricola wrote against Melancthon, and gave Count Mansfeld occasion to reproach him severely. He obtained a professorship at Wittemberg, where he taught particular doctrines, and became founder of the sect of Antinomians; which occasioned warm disputes between him and Luther, who had before been his very good friend. But though he was never able to recover the favour

either of the elector of Saxony or of Luther, he received some consolation from the fame he acquired at Berlin: where he became preacher at court; and was chosen in 1548, in conjunction with Julius Phlug and Michael Heldingus, to compose the famous *Interim*, which made so much noise in the world. He died at Berlin in 1566. ² Agricola

AGRICULTURE.

¹ Definition.

AGRICULTURE in general, or in the abstract, may be defined to be, The art of making the earth to produce in large quantities, and in the greatest perfection of which their nature is capable, those vegetables which are necessary to the subsistence, or useful for the accommodation of mankind. Agriculture differs from gardening in this respect, that the gardener is chiefly occupied in rearing small quantities of the nicer and more delicate vegetables, which are rather valued as objects of luxury than as articles of food; whereas the agriculturist labours upon a larger scale, with a view to supply himself and his countrymen with the necessaries of life.

² Differs from gardening.

³ Is a separate art.

⁴ Includes the rearing of cattle.

In civilized societies, agriculture, or the cultivation of the soil, becomes a separate business or employment; and agriculturists, or the persons engaged in agriculture, receive the appellation of *farmers* or *husbandmen*. To enable the agriculturist or husbandman to conduct his business with success, it is necessary that he should not confine his attention to the mere cultivation of the soil, or the rearing of vegetables. The vegetables which are capable of affording a comfortable subsistence to the human constitution are few in number; and it has been found by experience, that they cannot be profitably sown and reproduced year after year upon the same spot of ground. Hence it becomes necessary at times to rear upon it grasses or other vegetables which are unfit for affording nourishment to man. But although men cannot eat grass, they may, nevertheless, contrive to obtain subsistence from it in an indirect manner. They may give it to cattle, whose ordinary and natural food it is; and having thus, as it were, converted the grass into the flesh of animals, they can devour these animals; and in this way, obtain a richer and more stimulating food than any vegetable production can possibly afford: It is therefore a part of the business of the husbandman to rear and to feed those animals which are used as food in the society of which he is a member, that he may be enabled at all times to derive profit from the portion of territory that he cultivates. It is also necessary towards conducting his operations with success, that he should rear and feed other animals, not as a source of human subsistence, but for the sake of the services which they are capable of affording; for it has pleased the beneficent Contriver of this world, to place upon it beings of a subordinate nature, capable of assisting mankind in their labours, without being degraded by the state of servitude in which they are placed. To the cultivators of the soil, these animals, from their strength and patience of labour, are particularly useful, and

even absolutely necessary in our cold and barren climates. They must therefore be fed and lodged with the greatest care.

Hence the employment of the husbandman is of an ⁵ extensive nature, requiring much foresight, and a considerable knowledge of the relations that subsist between the most important objects in nature—the soil, the seasons, the animals, and the plants, so far as they are connected with the subsistence of mankind. It is by bringing to perfection this art that man becomes truly the lord of the universe. He subdues by his operations every part of the surface of the earth, and acquires over the animals which inhabit it, a solid right of dominion or of property, in consequence of having reared, and afforded them subsistence by his skill and his labour. He uses them indeed as food; but before he can do so, he must first bestow upon them subsistence, attend to their multiplication, and to their health and welfare. As they possess no foresight, the purpose to which they are destined is to them no evil.

It is only in proportion to the degree in which this important art of agriculture has flourished, that nations have been, or ever can be, permanently prosperous. Every improvement that is made in it is a moral benefit conferred upon mankind; for by increasing the quantity of human food, or facilitating the production of it, one of two things must always happen: Either the number of our species will be increased, that is to say, a greater multitude of rational and intelligent beings will exist in the creation; or a greater number of those who already exist, will find leisure for the improvement of their intellectual characters by studying and carrying to perfection the sciences and arts. Thus, the strength of nations is increased in proportion to the degree in which their soil is skilfully cultivated, and their independence is secured by finding upon the spot which they inhabit all that is necessary for their subsistence.

It is a fortunate circumstance, that the art of the ⁶ husbandman, which is the foundation of all others, and at all-times indispensable to human existence, is in every respect conducive to the welfare of those engaged in it. The practice of it bestows health upon the body; and by the variety of occupations which it affords, it also bestows a considerable degree of reflection upon the minds of the lowest persons occupied in it; while, at the same time, it prevents their acquiring that spirit of artifice and cunning, which in all countries is apt to degrade the character of those engaged in the inferior branches of commercial employment. Nor does it fail, in all ranks and conditions of life, to produce a more candid and liberal character than any other employment, ⁷ Its advantages to those who practice

ployment. No British husbandman has ever refused or even hesitated to allow to be communicated to the public every branch of his art, and every improvement which he and his forefathers may have made in it; whereas, in all the branches of manufacture or of commerce, every transaction, as far as possible, is covered with a mysterious veil of secrecy, and every improvement, as far as possible, is concealed by its inventor, and sometimes undoubtedly perishes with him.

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The antiquity of this art is undoubtedly beyond that of all others; for we are informed by Scripture, that Adam was sent from the garden of Eden, *to till the ground*; and, this being the case, he certainly must have known how to do so.—It would be ridiculous, however, to imagine that he was acquainted with all the methods of plowing, harrowing, fallowing, &c. which are now made use of; and it would be equally so to suppose, that he used such clumsy and unartful instruments as wooden hooks, horns of oxen, &c. to dig the ground, which were afterwards employed for this purpose by certain savages; but as we know nothing of the particular circumstances in which he was situated, we can know as little concerning his method of agriculture.

The prodigious length of life which the antediluvians enjoyed, must have been very favourable to the advancement of arts and sciences, especially agriculture, to which it behoved them to apply themselves in a particular manner, in order to procure their subsistence. It is probable, therefore, that even in the antediluvian world, arts and sciences had made great progress, nay, might be farther advanced in some respects than they are at present. Of this, however, we can form no judgment, as there are no histories of those times, and the Scripture gives us very slight hints concerning these matters.

No doubt, by the terrible catastrophe of the flood, which overwhelmed the whole world, many sciences would be entirely lost, and agriculture would suffer; as it was impossible that Noah or his children could put in practice, or perhaps know, all the different methods of cultivating the ground that were formerly used. The common methods, however, we cannot but suppose to have been known to him and his children, and by them transmitted to their posterity; so that as long as mankind continued in one body without being dispersed into different nations, the arts, agriculture especially, would necessarily advance; and that they did so, is evident from the undertaking of the tower of Babel. It is from the dispersion of mankind consequent upon the confusion of tongues, that we must date the origin of savage nations. In all societies where different arts are cultivated, there are some persons who have a kind of general knowledge of most of those practised through the whole society, while others are in a manner ignorant of every one of them. If we suppose a few people of understanding to separate from the rest, and become the founders of a nation, it will probably be a civilized one, and the arts will begin to flourish from its very origin; but, if a nation is founded by others whose intellects are in a manner callous to every human science (and of this kind there are many in the most learned countries), the little knowledge or memory of art that was among the original founders will be lost, and such a people will continue in a state of barbarism for many

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ages, unless the arts be brought to them from other nations.

From this, or similar causes, all nations of equal antiquity have not been equally savage, nor is there any solid reason for concluding that all nations were originally unskilled in agriculture; though, as we know not the original instruments of husbandry used by mankind when living in one society, we cannot fix the date of the improvements in this art. Different nations have always been in a different state of civilization; and agriculture, as well as other arts, has always been in different degrees of improvement among different nations at the same time.

From the earliest accounts of the eastern nations, we have reason to think, that agriculture has at all times been understood by them in considerable perfection; seeing they were always supplied not only with the necessities, but the greatest luxuries of life.

As soon as the descendants of Abraham were settled in Palestine, they generally became husbandmen, from the chiefs of the tribe of Judah to the lowest branch of the family of Benjamin. High rank or birth did not at that time make any distinction, for agriculture was considered as the most honourable of all employments; witness the illustrious examples of Gideon, Saul, and David.

The Chaldeans, who inhabited the country where agriculture had its birth, carried that valuable art to a degree of excellence unknown in former times. They cultivated their lands with great assiduity, and seem to have found out some means of restoring fertility to an exhausted soil, by having plentiful harvests in succession; on which account they were not obliged, as their predecessors had been, to change their situations, in order to obtain a sufficiency for themselves and their numerous flocks and herds.

The Egyptians, who from the natural fertility of their country by the overflowing of the Nile, raised every year vast quantities of corn, were so sensible of the blessings resulting from agriculture, that they ascribed the invention of that art to Osiris. They also regarded Isis, their second deity, as the discoverer of the use of wheat and barley, which before grew wild in the fields, and were not applied by that people to the purposes of food. Their superstitious gratitude was carried so far, as to worship those animals which were employed in tillage, and even the produce of their lands, as leeks, onions, &c.

The divine honours paid to Bacchus in India were derived from the same source, he being considered in that country as the inventor of planting vineyards, and the other arts attendant upon agriculture.

It is also related of the ancient Persians, on the most respectable authority, that their kings laid aside their grandeur once every month to eat with husbandmen. This is a striking instance of the high estimation in which they held agriculture; for at that time arts were practised among that people in great perfection, particularly those of weaving, needle-work, and embroidery. The precepts of their religion taught by their ancient magi, or priests, included the practice of agriculture. The *saint* among them was obliged to work out his salvation by pursuing all the labours of agriculture: And it was a maxim of the Zendavesta, that he who sows the ground with care and diligence, acquires a greater

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degree of religious merit, than he could have gained by the repetition of ten thousand prayers.

The Phœnicians, so well known in Scripture by the name of *Philistines*, were also remarkable for their attention to and skill in agriculture. But finding themselves too much disturbed and confined by the incursions and conquests of the Israelites, they spread themselves throughout the greatest part of the Mediterranean islands, and carried with them their knowledge in the arts of cultivation.

Mago, a famous general of the Carthaginians, is said to have written no less than 28 books on the subject; which Columella tells us were translated into Latin by the express order of the Roman senate. We are informed by the ancient writers, that Ceres was born in Sicily, where she first invented the arts of tillage and of sowing corn. For this essential service, she was, agreeably to the superstition of those ages, deified and worshipped as the goddess of plenty. The truth of this is, that, in the time of Ceres, the island, through her endeavours and the industry of the people, became very fruitful in corn; and agriculture was there esteemed so honourable an employment, that even their kings did not disdain to practise it with their own hands.

But time, which at first gave birth to arts, often caused them to be forgotten when they were removed from the place of their origin. The descendants of Noah, who settled in Europe, doubtless carried their knowledge of agriculture with them into the regions which they successively occupied. But those who took possession of Greece were such an uncivilized race, that they fed on roots, herbs, and acorns, after the manner of beasts. Pelasgus had taught them the culture of the oak, and the use of acorns as food; for which service, we are told, divine honours were paid him by the people.

The Athenians, who were the first people that acquired any tincture of politeness, taught the use of corn to the rest of the Greeks. They also instructed them how to cultivate the ground, and to prepare it for the reception of the seed. This art, we are told, was taught them by Triptolemus. The Greeks soon perceived that bread was more wholesome, and its taste more delicate, than that of acorns and the wild roots of the fields; accordingly they thanked the gods for such an unexpected and beneficial present, and honoured their benefactor.

As the arts of cultivation increased, and the blessings they afforded became generally experienced, the people soon preferred them to whatever the ravages of conquest, and the cruel depredations of savage life, could procure. And accordingly we find, that the Athenian kings, thinking it more glorious to govern a small state wisely, than to aggrandise themselves, and enlarge the extent of their dominions by foreign conquest, withdrew their subjects from war, and mostly employed them in cultivating the earth. Thus, by continued application, they brought agriculture to a considerable degree of perfection, and soon reduced it to an art.

Hesiod was the first we know of among the Greeks who wrote on this interesting subject. According to the custom of the oriental authors, he wrote in poetry, and embellished his poem with luxuriant description

and sublime imagery. He calls his poem *Works and Days*, because agriculture requires exact observations on times and seasons.

Xenophon has also, in his *Oeconomics*, remarked, that agriculture is the nursing mother of the arts. For, says he, "where agriculture succeeds prosperously, there the arts thrive; but where the earth necessarily lies uncultivated, there the other arts are destroyed."

Other eminent Greek writers upon agriculture were, Democritus of Abdera, Soeraticus, Archytas Tarentinus, Aristotle, and Theophrastus, from whom the art received considerable improvements.

The ancient Romans esteemed agriculture so honourable an employment, that the most illustrious senators of the empire, in the intervals of public concerns, applied themselves to this profession; and such was the simplicity of those ages, that they assumed no appearance of magnificence and splendour, or of majesty, but when they appeared in public. At their return from the toils of war, the taking of cities, and the subduing of hostile nations, their greatest generals were impatient till they were again employed in the arts of cultivation.

Regulus, when in Africa, requested of the senate to be recalled, lest his farm might suffer, for want of proper cultivation, in his absence, and the senate wrote him for answer, that it should be taken care of at the public expence, while he continued to lead their armies.

Cato the censor, after having governed extensive provinces, and subdued many warlike nations, did not think it below his dignity to write a Treatise on Agriculture. This work (as we are told by Servius) he dedicated to his own son, it being the first Latin treatise written on this important subject; and it has been handed down to us in all its purity, in the manner that Cato wrote it.

Varro composed a treatise on the same subject, and on a more regular plan. This work is embellished with all the Greek and Latin erudition of that learned author, who died 28 years before the commencement of the Christian æra. Virgil who lived about the same time, has, in his *Georgics*, adorned this subject with the language of the Muses, and finely illustrated the precepts and rules of husbandry left by Hesiod, Mago, and Varro.

Columella, who flourished in the reign of the emperor Claudius, wrote 12 books on husbandry, replete with important instruction.

From this period to that of the reign of Constantine Paganatus, husbandry continued in a declining state; but that wise emperor caused a large collection of the most useful precepts relating to agriculture to be extracted from the best writers, and published them under the title of *Geoponics*. It has been asserted, that he made this collection with his own hand; and the truth of the assertion is not improbable, as it is well known that after he had conquered the Saracens and Arabians, he not only practised and encouraged, but studied the arts of peace, fixing his principal attention on agriculture as their best foundation.

After the death of Constantine, however, the increasing attention of the people to commerce, and the ignorance and gross superstition of the ages which succeeded, seem to have rendered agriculture an almost neglected

glected science. The irruptions of the northern nations soon abolished any improved system. These innumerable and enterprising barbarians, who overran all Europe, were originally shepherds or hunters, like the present Tartars and the savages of America. They contented themselves with possessing, without labour or trouble, those vast countries rendered deserts by their own ravages, cultivating only a very small spot near their habitations; and in this trifling husbandry only the meanest slaves were employed: so that the art itself, which formerly was thought worthy of the study of kings, was now looked upon as mean and ignoble; a prejudice which is scarcely effaced at present, or at least but very lately.—During this period, therefore, we find no vestiges of any thing tolerably written on the subject. No new attempts were made to revive it, or to improve it, till the year 1478, when Crescenzo published an excellent performance on the subject at Florence. This roused the slumbering attention of his countrymen, several of whom soon followed his example. Among these Tatti, Stephano Augustino Gallo, Sansovino, Lauro, and Tarello, deserve particular notice.

From the fall of the Roman empire, till the revival of learning in the fifteenth century, little is known of the state of agriculture in any part of Europe; and even that little must be gleaned from the incidental notices of historians, who were too much occupied in recording the achievements of war, with the rude policy and intestine broils of their respective countries, to give much attention to the peaceful, and at that time degraded, labours of the husbandman. The policy of the feudal system, the distribution of society which it occasioned, and the perpetual dissensions and petty hostilities which it engendered, furnish the best evidence of the low state of an art which can flourish only under the protection of law, and be carried on with success only by the energy of free men. But, during this long interval, the population of Europe was divided into two great classes, of which by far the larger one was composed of bondmen, without property, or the power of acquiring it, and small tenants, very little superior to bondmen; and the other class, consisting chiefly of the great barons and their retainers, was more frequently employed in laying waste the fields of their rivals than in improving their own. The superstition of the times, which destined a large portion of the country to the support of the church, and which, in some measure, secured it from predatory incursions, was the principal source of what little skill and industry were then displayed in the cultivation of the soil. "If we consider the ancient state of Europe," says Mr Hume, (A) "we shall find that the far greater part of the society were every where bereaved of their *personal* liberty, and lived entirely at the will of their masters. Every one that was not noble was a slave; the peasants were sold along with the land; the few inhabitants of cities were not in a better condition; even the gentry themselves were subjected to a long train of subordination under the greater barons, or chief vassals of the

crown, who, though seemingly placed in a high state of splendour, yet, having but a slender protection from law, were exposed to every tempest of the state, and, by the precarious condition in which they lived, paid dearly for the power of oppressing and tyrannizing over their inferiors.—The villains were entirely occupied in the cultivation of their master's land, and paid their rents either in corn and cattle, and other produce of the farm, or in servile offices, which they performed about the baron's family, and upon farms which he retained in his own possession. In proportion as agriculture improved, and money increased, it was found that these services, though extremely burdensome to the villain, were of little advantage to the master; and that the produce of a large estate could be much more conveniently disposed of by the peasants themselves, who raised it, than by the landlord or his bailiff, who were formerly accustomed to receive it. A commutation was, therefore, made of rents for services, and of money-rents for those in kind; and as men in a subsequent age discovered, that farms were better cultivated where the farmer enjoyed security in his possession, the practice of granting leases to the peasant began to prevail, which entirely broke the bonds of servitude, already much relaxed from the former practices. The latest laws which we find in England, for enforcing or regulating this species of servitude, were enacted in the reign of Henry VII. And though the antient statutes on this subject remain still unrepealed by Parliament, it appears, that before the end of Elizabeth, the distinction between villain and free-man, was totally, though insensibly, abolished; and that no person remained in the state, to whom the former laws could be applied."

But, long before the fifteenth century, it is certain that there was a class of tenants, holding on leases for lives, or for a term of years, and paying a rent in land produce, in services, or in money. Whether they gradually sprung up from the class of bondmen, according to Lord Kames, (B) or existed from the earliest period of the feudal constitution, according to other writers, (C) their number cannot be supposed to have been considerable during the middle ages. The stock which these tenants employed in cultivation, commonly belonged to the proprietor, who received a proportion of the produce as rent;—a system, which still exists in France, where such tenants are called *metayers*, and some vestiges of which may yet be traced in the *steel-bow* of the law of Scotland. Leases of the 13th century still remain; (D) and both the laws and chartularies, (E) clearly prove the existence in Scotland, of a class of cultivators, distinct from the *serfs* or bondmen. Yet the condition of these tenants seems to have been very different from that of the tenants of the present day; and the lease approached nearer in its form to a feu-charter, than to the mutual agreement now in use. It was of the nature of a beneficiary grant by the proprietor, under certain conditions, and for a limited period: the consent of the tenant seems never to have been doubted. In

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the

(A) History of England, chap. 23.

(B) Kames's Law Tracts.

(C) Bell's Treatise on Leases.

(D) Sir John Cullum's History and Antiquities of Hawsted (Suffolk).

(E) Chalmers's Caledonia, Book 4. chap. 6.

the common expression, *granting* a lease, we have retained an idea of the original character of the deed even to the present time.

The corn crops cultivated during this period seem to have been of the same species, though all of them probably much inferior in quality to what they are in the present day. Wheat, the most valuable grain, must have borne a small proportion, at least in Britain, to that of other crops; the remarkable fluctuation of price; its extreme scarcity, indicated by the extravagant rate at which it was sometimes sold; as well as the preparatory cultivation required, may convince us, that its consumption was confined to the higher orders, and that its growth was by no means extensive. Rye and oats furnished the bread and drink of the great body of the people of Europe. Cultivated herbage and roots were then unknown in the agriculture of Britain. It was not till the end of the reign of Henry VIII. that any salads, carrots, or other edible roots, were produced in England. The little of these vegetables that was used, was formerly imported from Holland and Flanders. Queen Catherine, when she wanted a salad, was obliged to despatch a messenger thither on purpose (F).

The ignorance and insecurity of those ages, which necessarily confined the cultivation of corn to a comparatively small portion of country, left all the rest of it in a state of nature, to be depastured by the inferior animals, then only occasionally subjected to the care and controul of man. Cultivators were crowded together in miserable hamlets; the ground contiguous was kept continually under tillage; and beyond this, wastes and woodlands of much greater extent were appropriated to the maintenance of their flocks and herds, which pastured indiscriminately with little attention from their owners.

The low price of butcher meat, though it was then the food of the common people, when compared with the price of corn, has been justly noticed by several writers, as a decisive proof of the small progress of civilization and industry.

At what time agriculture was introduced into Britain is uncertain. When Julius Cæsar first invaded this island, it was not wholly unknown. That conqueror was of opinion, that agriculture was first introduced by some of those colonies from Gaul which had settled in the southern parts of Britain, about 100 years before the Roman invasion*.

* Cæsar de
Bell. Gall.
lib. v. c. 12.

† Plin. Nat.
Hist. l. xvii.
cap. 9.

It is not to be expected that we can now be acquainted with many of the practices of these ancient husbandmen. It appears, however, that they were not unacquainted with the use of manures, particularly marl. This we have on the authority of Pliny†, who tells us, that it was peculiar to the people of Gaul and of Britain; that its effects continued 80 years; and that no man was ever known to marl his field twice, &c.—It is highly probable, too, that lime was at this time also used as a manure in Britain, it being certainly made use of in Gaul for this purpose at the time of Julius Cæsar's invasion.

The establishment of the Romans in Britain produ-

ced great improvements in agriculture, insomuch that prodigious quantities of corn were annually exported from the island; but when the Roman power began to decline, this, like all the other arts, declined also, and was almost totally destroyed by the departure of that people. The unhappy Britons were now exposed to frequent incursions of the Scots and Picts, who destroyed the fruits of their labours, and interrupted them in the exercise of their art. After the arrival of the Saxons in the year 449, they were involved in such long wars, and underwent so many calamities, that the husbandmen gradually lost much of their skill, and were at last driven from those parts of their country which were most proper for cultivation.

After the Britons retired into Wales, though it appears from the laws made relative to this art, that agriculture was thought worthy of the attention of the legislature, yet their instruments appear to have been very unartful. It was enacted that no man should undertake to guide a plough who could not make one; and that the driver should make the ropes of twisted willows, with which it was drawn. It was usual for six or eight persons to form themselves into a society for fitting out one of these ploughs, providing it with oxen and every thing necessary for ploughing; and many minute and curious laws were made for the regulation of such societies. If any person laid dung on a field with the consent of the proprietor, he was by law allowed the use of that land for one year. If the dung was carried out in a cart in great abundance, he was to have the use of the land for three years. Whoever cut down a wood, and converted the ground into arable, with the consent of the owner, was to have the use of it for five years. If any one folded his cattle, for one year, upon a piece of ground belonging to another, with the owner's consent, he was allowed the use of that field for five years.

Thus, though the Britons had in a great measure lost the knowledge of agriculture, they appear to have been very assiduous in giving encouragement to such as would attempt a revival of it; but among the Anglo-Saxons, things were not at present in so good a state. These restless and haughty warriors, having contracted a distaste and contempt for agriculture, were at pains to enact laws to prevent its being followed by any other than women and slaves. When they first arrived in Britain, they had no occasion for this art, being supplied by the natives with all the necessaries of life. After the commencement of hostilities, the Saxons subsisted chiefly by plunder: but having driven out or extirpated most of the ancient Britons, and divided their lands among themselves, they found themselves in danger of starving, there being now no enemy to plunder; and therefore they were obliged to apply to agriculture.

The Saxon princes and great men, who, in the division of the lands, had received the greatest shares, are said to have subdivided their estates, into two parts, which were called the *in-lands* and the *out-lands*. The *in-lands* were those which lay most contiguous to the mansion-house of their owner, which he kept in his own

own possession, and cultivated by his slaves, under the direction of a bailiff, for the purpose of raising provisions for the family. The out-lands were those at a greater distance from the house, and were let to the *ceorls*, or farmers of those times, at very moderate rents. By the laws of Ina king of the West Saxons, who reigned in the end of the seventh and beginning of the eighth century, a farm consisting of ten hides, or plough-lands, was to pay the following rent: "Ten casks of honey; three hundred loaves of bread; twelve casks of strong ale; thirty casks of small ale; two oxen; ten wedders; ten geese; twenty hens; ten cheeses; one cask of butter; five salmon; twenty pounds of forage; and one hundred eels." From this low rent, the imperfection of agriculture at that time is easily discoverable; but it is still more so from the low prices at which land was then sold. In the ancient history of the church of Ely, published by Dr Gale, there are accounts of many purchases of lands by Ædelwold the founder of that church, and by other benefactors, in the reign of Edgar the Peaceable, in the tenth century. By a comparison of these accounts it appears, that the ordinary price of an acre of the best land in that part of England, in those times, was no more than 16 Saxon pennies, or about four shillings of our money: a very trifling price, even in comparison with that of other commodities at the same time: for, by comparing other accounts, it appears, that four sheep were then equal in value to an acre of the best land, and one horse of the same value with three acres. The frequent and deplorable famines which afflicted England about this time, are further instances of the wretched state of agriculture. In 1043, a quarter of wheat sold for 60 Saxon pennies (15 of our shillings), at that time equal in value to seven or eight pounds of our money now.

The invasion of the Normans in 1066, contributed very much to the improvement of agriculture; for, by that event, many thousands of husbandmen from Flanders, France, and Normandy, settled in Britain, obtained estates or farms, and cultivated them after the manner of their country. The implements of husbandry, used at this time, were of the same kind with those employed at present; but some of them were less perfect in their construction. The plough, for example, had but one stilt or handle, which the ploughman guided with one hand, having in his other hand an instrument which served both for cleaning and mending the plough, as well as for breaking the clods. The Norman plough had two wheels; and in the light soil of Normandy, was commonly drawn by one or two oxen; but, in England, a greater number was often necessary. In Wales, the person who conducted the oxen in the plough walked backwards. Their carts, harrows, scythes, sickles, and flails, from the figures of them still remaining, appear to have been nearly of the same construction with those that are now used. In Wales they did not use a sickle for reaping their corns, but an instrument like the blade of a knife, with a wooden handle at each end.—Their chief manure, next to dung, seems still to have been marl. Summer-fal-

lowing of lands designed for wheat, and ploughing them several times, appear to have been frequent practices of the English farmers in this period.

Of the state of agriculture in England, we may obtain a nearer view, by shortly adverting to some of the laws from the Conquest, down to the beginning of the reign of Henry VII. in 1485, when the feudal system, which had been gradually falling into decay, was almost dissolved in that country.

One of the earliest and greatest grievances, was the levying of *purveyance*. This originally comprehended the necessary provisions, carriages, &c. which the nearest farmers were obliged to furnish to the king's armies at the current prices; and to his houses and castles in time of war. It was called the *great purveyance*, and the officers who collected those necessities were called *purveyors*. The *smaller purveyance* included the necessary provisions and carriages for the king's household, when living at home, or travelling through the kingdom, which the tenants on the king's demesne lands were obliged to furnish *gratis*; and the practice came to be adopted by the barons and great men, in every tour which they thought proper to make in the country. These exactions were so grievous, and levied in so licentious a manner, that the farmers, when they heard of the court's approach, often deserted their houses, as if the country had been invaded by an enemy. "Purveyance," says Dirom, (G) "was, perhaps, for many centuries, the chief obstruction to the agriculture and improvement of Great Britain. Many laws were made for the reformation and regulation of *purveyance*, but without effect; and the practice continued down to so late a period as the reign of James the First."

The home trade in corn and other products was restrained, by acts against forestallers in 1360, and at several subsequent periods. For many years after the Conquest, the greater part of the trade of England was carried on in markets and fairs; and a very considerable part of the revenue of the crown arose from the duties payable to the king upon the goods brought to them for sale. The barons had also tolls at the fairs within their respective jurisdictions. When farmers and merchants were bringing their corn and other necessities to be sold there, they were sometimes met on the way by persons who purchased their commodities in order to retail them at a higher price. Thus, the king and the lord of the manor, lost the several duties payable to them; and the price, it was thought, was at the same time raised to the inhabitants. Such were the original forestallers, who were subjected by several statutes to severe penalties. This crime of *forestalling*, and the kindred ones of *regrating* and *ingrossing*, were carefully defined, and the different degrees of punishment specified, in a new statute in 1552, to be afterwards noticed. An early law of 1266, for regulating the assize of bread and ale, furnishes a clear proof of the little intercourse that must have subsisted at that time between town and country. "Brewers in cities," says the statute, "may well afford to sell two gallons of beer or ale for a penny, and out of cities three or four gallons for a penny."

Several

Several laws were made in the 14th and 15th centuries, permitting the exportation of grain, when the price of wheat did not exceed six shillings and eight-pence a quarter; and in 1463 importation was prohibited when the price was lower. The last statute, however, was little attended to, and foreign grain was admitted as before; while the state of the country, and the restrictions on internal commerce, scarcely permitted any advantage to be derived from the acts allowing exportation.

In the elaborate work of Mr Chalmers already referred to, a great many valuable notices are collected regarding the husbandry of Scotland during these ages. It is evident from his researches, that the progress of cultivation, in the 13th century, had been greater than we should have expected from the turbulence of the times, and the comparatively rude and uncivilized state of society. Purveyance, and other obstructions to improvement, were nearly the same in Scotland as in England; the laws regarding the corn trade appear in some instances to have been copied from those of England; and in the northern, as in the southern part of the island, the clergy were by far the most skilful and industrious husbandmen.

Yet it is difficult to reconcile the idea of any considerable improvement, particularly in so far as regards the extensive cultivation of wheat, (which Mr Chalmers infers from the authorities he quotes), with an act passed in 1426, which ordained every husbandmen, tilling with a plough of eight oxen, to sow at least a firloft (little more than a Winchester bushel) of wheat, and half a firloft of pease, with a proportion of beans; or with the state of the districts where wheat is said to have been extensively grown, only a few years ago.

By statute 1449, the tenant was for the first time secured in possession during the term of his lease, against a purchaser of the land; and in 1469, he was protected from having his property carried off for the landlord's debts, beyond the amount of rent actually due; a statute which proves his miserable condition before that time.

Soon after the beginning of the 16th century, agriculture partook of the general improvement which followed the invention of the art of printing, the revival of literature, and the more settled authority of government; and, instead of the occasional notices of historians, we can now refer to regular treatises, written by men who engaged eagerly in this neglected, and hitherto degraded, occupation. We shall therefore give a short account of the principal works, as well as of the laws and general policy of Britain in regard to agriculture, from the early part of the 16th century to the Revolution in 1688, when a new era commenced in the legislation of corn, and soon after in the practice of the cultivator.

The first, and by far the best of our early works, is *The Book of Husbandry*, printed in 1534, commonly ascribed to Fitzherbert, a Judge of the Common Pleas in the reign of Henry VIII. This was followed, in 1539, by *The Book of Surveying and Improvements*, by the same author. In the former treatise we have a clear and minute description of the rural practices of that period; and from the latter may be learned a good deal of the economy of the feudal system in its decline. *The Book of Husbandry* has scarcely been excelled by any

later production, in as far as concerns the subjects of which it treats; for at that time, cultivated herbage and edible roots were still unknown in England. The author writes from his own experience of more than forty years; and, if we except his biblical allusions, and one or two vestiges of the superstition of the Roman writers about the influence of the moon, there is very little of this valuable work that should be omitted, and not a great deal that need be added, in so far as regards the culture of corn, in a manual of husbandry adapted even to the present time. Fitzherbert touches on almost every department of the art; and, in about a hundred octavo pages, has contrived to condense more practical information, than will be found scattered through as many volumes of later times; and yet he is minute even to an extreme on points of real utility. There is no reason to say, with Mr Hart, that he had revived the husbandry of the Romans; he merely describes the practices of the age in which he lived; and from his commentary on the old statute *extenta manerii*, in his *Book of Surveying*, in which he does not allude to any recent improvements, it is probable that the management which he details had been long established. But it may surprise some of the agriculturists of the present day to be told, that, after the lapse of almost three centuries, Fitzherbert's practice, in some material branches, has not been improved upon; and that in several districts abuses still exist, which were as clearly pointed out by him at that early period, as by any writer of the present age.

The *Book of Husbandry* begins with the plough, and other instruments, which are concisely and particularly described; and then about a third part of it is occupied with the several operations, as they succeed one another throughout the year. Among other things in this part of the work, the following deserve notice. "Somme (ploughs) wyll tourn the sheld bredith at every landes ende, and plowe all one way;" the same kind of plough that is now found so useful on hilly grounds. Of wheel ploughs, he observes, that "they be good on even grounde that lyeth lyghte;" and on such lands they are still most commonly employed. Cart wheels were sometimes bound with iron, of which he greatly approves. On the much agitated question about the employment of horses or oxen in labour, the most important arguments are distinctly stated. "In somme places," he says, "a horse plough is better," and in others an oxen plough; to which, upon the whole, he gives the preference; and to this, considering the practices of that period, they were probably entitled. Beans and pease seem to have been common crops. He mentions the different kinds of wheat, barley, and oats; and, after describing the method of harrowing "all maner of cornnes," we find the roller employed. "They use to role theyr barley grounde after a shower of rayne, to make the ground even to mowe." Under the article "To Falowe," he observes, "the greater clottes (clods), the better wheate, for the clottes kepe the wheate warm all wynter; and at March they will melte, and breake and fal in manye small peces, the whiche is a newe dongynge and refreshynge of the corne." This is agreeable to the present practice, founded on the very same reasons. "In May, the shepe folde is to be set out;" but Fitzherbert does not much approve of folding, and points out its disadvantages

tages in a very judicious manner. "In the later end of May, and the begynnyng of June, is tyme to weede the corne;" and then we have an accurate description of the different weeds, and the instruments and mode of weeding. Next comes a second ploughing of the fallow; and afterwards, in the latter end of June, mowing the meadows begins. Of this operation, and of the forks and rakes, and the haymaking, there is a very good account. The corn harvest naturally follows; rye and wheat were usually *shorn*, and barley and oats cut with the scythe. This intelligent writer does not approve of the practice, which still prevails in some places, of cutting wheat high, and then mowing the stubbles. "In Somersetshire," he says, "they do shere theyr wheat very lowe; and the wheate strawe that they purpose to make *thacke* of, they do not thresh it, but cut off the ears, and bind it in sheaves, and call it *rede*, and therewith they thacke theyr houses." He recommends the practice of setting up corn in shocks, with two sheaves to cover eight, instead of ten sheaves, as at present; probably owing to the straw being then shorter. The corn was commonly housed; but if there be a want of room, he advises that the ricks be built on a scaffold, and not upon the ground. Corn-stacks are now beginning to be built on pillars and frames. The fallow received a third ploughing in September, and was sown about Michaelmas. "Wheat is moost commonlye sown under the forowe, that is to say, cast it uppon the falowe, and then plowe it under." And this branch of his subject is concluded with directions about thrashing, winnowing, and other kinds of barn-work.

Fitzherbert next proceeds to live stock. "An housbande," he says, "can not well thryue by his corne, without he haue other cattell, nor by his cattell, without corne.—And bycause that shepe, in myne opnyon, is the mooste profytablest cattell that any man can haue; therefore I purpose to speake fyrst of shepe." His remarks on this subject are so accurate, that one might imagine they came from a storemaster of the present day; and the minutiae which he details are exactly what the writer of this article has seen practised in the hilly parts of this country. In some places at present, "they neuer seuer their lambes from their dammes;—and the poore of the peeke (high) countrey, and such other places, where, as they vse to mylke theyr ewes, they vse to wayne theyr lambes at 12 wekes olde, and to mylke theyr ewes fve or syxe wekes;—but that (he observes) is greate hurte to the ewes, and wyll cause them that they will not take the ramme at the tyme of the yere for pouertye, but goo barreyne.—In June is tyme to shere shepe; and ere they be shorne, they must be very well washen, the which shall be to the owner greate profyte in the sale of his wool, and also to the clothe maker." It appears that *hand-washing* was then a common practice; and yet, in the west and north of Scotland, at this day, sheep are never washed at all. His remarks on horses, cattle, &c. are not less interesting; and there is a very good account of the diseases of each species, and some just observations on the advantage of mixing different kinds on the same pasture. Swine and bees conclude this branch of the work.

The author then points out the great advantages of enclosures; recommends "quycksettyng, dychyng,

and hedgeyng;" and gives particular directions about the *settes*, and the method of training a hedge, as well as concerning the planting and management of trees. We have then a short information "for a yonge gentylman that intendeth to thrye;" and "a prologue for the wiues occupation;" in some instances rather too homely for the present time. Among other things, she is to "make her husband and herself sonne clothes;" and "she maye haue the lockes of the shepe eyther to make blankettes and couerlettes, or bothe." This is not so much amiss; but what follows will bring our learned judge into disrepute, even with our most industrious housewives. "It is a wyues occupation, to wynowe all maner of cornes, to make malte, to washe and wyrynge, to make heye, shere corne, and, in time of nede, to helpe her husbnde to fyll the mucke wayne or dounge carte, dryue the ploughc, to loode hey, corne, and suche other. And to go or ride to the market, to sel butter, chese, mylke, eggcs, chekyns, capons, henncs, pygges, gese, and all maner of cornes." The rest of the book contains some useful advices about diligence and economy; and concludes, after the manner of the age, with many pious exhortations.

Such is Fitzherbert's *Book of Husbandry*, and such was the state of agriculture in England in the early part of the 16th century, and probably for a long time before; for he nowhere speaks of the practices which he describes or recommends as of recent introduction.

The Book of Surveyinge adds considerably to our knowledge of the rural economy of that age. "Four maner of commens" are described; several kinds of mills for corn, and other purposes, and also "quernes that goo with hand;" different orders of tenants, down to the "boundmen," who "in some places contynue as yet;"—"and many tymes, by colour thereof, there be many freemen taken as boundmen, and their lands and goods is taken from them." Lime and marl are mentioned as common manures; and the former was sometimes spread on the surface to destroy heath. Both draining and irrigation are noticed; though the latter but slightly. And the work concludes with an inquiry, "Howe to make a township that is worth XX. marke a yere, worth XX. li. a year;" from which we shall give a specimen of the author's manner, as well as of the economy of the age.

"It is undonbted, that to every townshyppe that standeth in tyllage in the playne countrey, there be errable landes to plowe, and sowe, and leyse to tye or tedder theyr horses and mares upon, and common pasture to kepe, and pasture theyr catell, beestes, and shepe upon. And also they have medowe grounde to get theyr hey upon. Than to let it be known how many acres of errable lande euery man hath in tyllage, and of the same acres in euery felde to chaunge with his neyghbours, and to leye them togyther, and to make hym one seuerall close in euery felde, for his errable landes and his leyse in euery felde, to leye them togyther in one felde, and to make one seuerall close for them all. And also another seuerall close for his portion of his common pasture, and also his porcion of his medowe in a senerall close by itselfe, and al kept in seuerall both in wynter and somer; and euery cottage shall have his portion assigned hym accordyng to his rent, and than shall nat the ryche man ouerpresse the poore.

poore man with his cattell, and every man may eate his own close at his pleasure. And vndoubted, that hay and strawe that will find one beest in the house wyll finde two beestes in the close, and better they shall lyke. For those beestis in the house have short heare and thynne, and towards March they will pylle and be bare. And therefore they may nat abyde in the fylde byfore the heerdmen in winter tyme for colde. And those that lie in a close under a hedge have longe heare and thicke, and they wyll neuer pylle nor be bare, and by this reeson the husbände maye kepe twyse so many cattell as he did before.

"This is the cause of this approwment. Nowe every husbände hath sixe severall closes, whereof iii. be for corne, the fourthe for his leyse, the fyfte for his commen pastures, and the sixte for his haye; and in wynter time there is but one occupied with corne, and than hath the husbände other fyue to occupy tylle lente come, and that he hath his falowe felde, his ley felde, and his pasture felde al sommer. And when he hath mowen his medowe, than he hath his medowe grounde, soo that if he hath any weyke cattell that wold be amended, or dyvers manner of cattell, he may put them in any close he wyll, the which is a great aduantage; and if all shulde lye commen, than wolde the edyche of the corne felde and the aftermath of all the meadowes be eaten in X. or XII. dayes. And the rych men that hath moche cattell, wold have the advantage, and the poore man can have no helpe nor relefe in wynter, whan he hath moste nede; and if an acre of lande be worthe sixe pens or it be enclosed, it will be worth VIII. pens whan it is enclosed, by reason of the compostyng and dongyng of the cattell that shall go and lye upon it both day and night; and if any of his three closes that he hath for his corne be worn or ware bare, than he may breke and plowe up his close that he hadde for his leyse, or the close that he hadde for his commen pasture, or bothe, and sowe them with corne, and let the other lye for a time, and so shall he have alway reist grounde, the which will bear moche corne with lytel donge; and also he shall have a great profyte of the wod in the hedges whan it is growen, and not only these profytes and advantages beforesaid, but he shall save moche more than al these; for by reason of these closes, he shall save meate, drinke, and wages of a shepherde, the wages of the heerdman, and the wages of the swine heerde, the which may fortune to be as chargeable as all his holle rent, and also his corne shall be better saued from eatinge or distroyng with catel. For dout ye nat but heerdmen with their cattell, shepherdes with their shepe and tieng of horses and mares, distroyeth moch corne, the which the hedges wold saue. Paradventure some men would say, that this shuld be against the common weale, because the shepherdes, heerdmen, and swyneherdes, shuld than be put out of wages. To that it may be answered, though these occupations be not used, there be as many newe occupations that were not used before. As gettyng of quickettes, dyching, hedging, and plashing, the which the same men may use and occupye."

The next author who writes professedly on agricul-

ture is *Tusser*, whose *Five Hundred Points of Husbandry* was published in 1562, and has been recommended by Lord Molesworth to be taught in schools (H). The edition of 1604 is the one we make use of here, in which the *Book of Husbandry* consists of 118 pages; and then follows the *Points of Housewiferie*, occupying 42 pages more. It is written in verse. Amidst a vast heap of rubbish, there are some useful notices concerning the state of agriculture in different parts of England. Hops, which had been introduced in the early part of the 16th century, and on the culture of which a treatise was published in 1574 by Reynolde Scott, are mentioned as a well known crop. Buckwheat was sown after barley. It seems to have been the practice then, in some places, to "geld fillies" as well as colts. Hemp and flax are mentioned as common crops. Enclosures must have been numerous in several counties; and there is a very good "comparison between champion (open fields) country, and severall" which Blythe afterwards transcribed into his *Improver Improved*. Carrots, cabbages, turnips, and rape, are mentioned among the herbs and roots for the kitchen. There is nothing to be found in *Tusser* about *serfs*, or bondmen, as in Fitzherbert's works. This author's division of the crop is rather curious, though probably quite inaccurate, if he means that the whole rent might be paid by a tenth of the corn. But this, perhaps, is not his meaning.

"One part cast forth for rent due out of hand.

One other part for seed to sow thy land.

Another part leaue parson for his tith.

Another part for harvest, sickle and sith.

One part for ploughwrite, cartwrite, knacker and smith.

One part to uphold thy teemes that draw therewith.

Another part for servant and workman's wages laie.

One part likewise for filbellie daie by daie.

One part thy wife for needful things doth craue.

Thyself and thy child the last part would have."

The next writer is *Barnaby Googe*, whose *Whole Art of Husbandry* was printed in 1578, and again by Markham in 1614. The first edition is merely a translation of a German work; and very little is said of English husbandry in the second, though Markham made some trifling interpolations, in order, as it is alleged, to adapt the German husbandry to the English climate. It is, for the most part, made up of gleanings from all the ancient writers of Greece and Rome, whose absurdities are faithfully retained; with here and there some description of the practices of the age, in which there is little of novelty or importance. Googe mentions a number of English writers who lived about the time of Fitzherbert, whose works have not been preserved.

For more than 50 years after this, or till near the middle of the 17th century, there are no systematic works on husbandry, though several treatises on particular departments of it. From these it is evident, that all the different operations of the farmer were performed with more care and correctness than formerly; that

that the fallows were better worked; the fields kept freer of weeds, and much more attention paid to manures of every kind. A few of the writers of this period deserve to be shortly noticed.

Sir Hugh Plat, in his *Jewel House of Art and Nature*, printed in 1594, (which Weston in his Catalogue erroneously gives to Gabriel Plattes), makes some useful observations on manures, but chiefly collected from other writers. His censure of the practice of leaving farm dung lying scattered about is among the most valuable.

Sir John Norden's *Surveyor's Dialogue*, printed in 1607, and reprinted with additions in 1618, is a work of considerable merit. The first three books of it relate to the rights of the Lord of the Manor, and the various tenures by which landed property was then held, with the obligations which they imposed: Among others, we find the singular custom, so humorously described in the Spectator, about the incontinent widow riding upon a ram. In the fifth book, there are a good many judicious observations on the "different natures of grounds, how they may be employed, how they may be bettered, reformed and amended." The famous meadows near Salisbury are mentioned; and when cattle have fed their fill, hogs, it is pretended, "are made fat with the remnant, namely with the knots and sappe of the grasse." So many extravagant assertions have been made about these meadows by several of our early writers, that we ought to receive their statements with some degree of scepticism, wherever they seem to approach the marvellous. "Clouer grasse, or the grasse honey suckle," (white clover), is directed to be sown with other hay seeds. "Carrot rootes" were then raised in several parts of England, and sometimes by farmers. London street and stable dung was carried to a distance by water; though it appears from later writers to have been got almost for the trouble of removing. And leases of twenty-one years are recommended for persons of small capital, as better than employing it in purchasing land;—an opinion that prevails very generally among our present farmers.

Bees seem to have been great favourites with these early writers; and among others, there is a treatise by Butler, a gentleman of Oxford, called the *Feminine Monarchie*, or the *History of Bees*, printed in 1609, full of all manner of quaintness and pedantry.

We shall pass over Markham, Mascall, Gabriel Plattes, and several other authors of this period, the best part of their writings being preserved by Blythe and Hartlib, of whom we shall say a little immediately. In Sir Richard Weston's *Discourse on the Husbandry of Brabant and Flanders*, published by Hartlib in 1645, we may mark the dawn of the vast improvements which have since been effected in Britain. This gentleman was ambassador from England to the elector palatine and king of Bohemia in 1619, and had the merit of being the first who introduced the *great clover*, as it was then called, into English agriculture about 1645, and probably turnips also. His directions for the cultivation of clover are better than was to be expected. It thrives best, he says, when you sow it on the worst and barrenest grounds, such as our worst heath ground is in England. The ground is to be pared and burnt; unslacked lime must be added to the ashes. The ground is next to be well ploughed and harrowed; and about

ten pounds of clover seed must be sown on an acre, in April or the end of March. If you intend to preserve seed, then the second crop must be let stand till it come to a full and dead ripeness; and you shall have at the least five bushels per acre. Being once sown, it will last five years; and then being ploughed, it will yield three or four years together rich crops of wheat, and after that a crop of oats, with which clover seed is to sowed again. It is in itself an excellent manure, Sir Richard adds; and so it should be, to enable land to bear this treatment. In less than ten years after its introduction, that is, before 1655, the culture of clover, exactly according to the present method, seems to have been well known in England; and it had then made its way even to Ireland.

A great many works on agriculture appeared during the time of the commonwealth, of which Blythe's *Improver Improved*, and Hartlib's *Legacy*, are the most valuable. The first edition of the former was published in 1649, and of the latter in 1650; and both of them were enlarged in subsequent editions. In the first edition of the *Improver Improved*, no mention is made of clover, nor in the second of turnips; but, in the third, published in 1662, clover is treated of at some length; and turnips are recommended as an excellent cattle crop, the culture of which should be extended from the kitchen garden to the field. Sir Richard Weston must have cultivated turnips before this; for Blythe says, that "Sir Richard affirmed to himself, he did feed his swine with them; they were first given boiled, but afterwards the swine came to eat them raw," and "would run after the carts and pull them forth as they gathered them;" an expression which conveys an idea of their being cultivated in the fields.

Blythe's book is the first systematic work, in which there are some traces of the convertible husbandry, so beneficially established since, by interposing clover and turnip between culmiferous crops. He is a great enemy to commons and common fields; and to retaining land in old pasture, unless it be of the best quality. His description of different kinds of ploughs is interesting; and he justly recommends such as were drawn by two horses (some even by one horse) in preference to the weighty clumsy machines, which required four horses or oxen, or more. Almost all the manures now used seem to have been then well known; and he brought lime himself from a distance of 20 miles. He speaks of an instrument which ploughed, sowed, and harrowed at the same time; and the *setting of corn* was then a subject of much discussion. "It was not many years," says Blythe, "since the famous city of London petitioned the parliament of England against two anasancies or offensive commodities, which were likely to come into great use and esteem; and that was Newcastle coal, in regard of their stench, &c.; and hops, in regard they would spoyle the taste of drink, and endanger the people!"

Hartlib's *Legacy* is a very heterogeneous performance, containing, among some very judicious directions, a great deal of rash speculation. Several of the deficiencies which the writer (R. Child) complains of in English agriculture, must be placed to the account of our climate, and never have been nor can be supplied. Some of his recommendations are quite unsuitable to the state of the country, and display more of general knowledge

knowledge and good intention, than of either the theory or practice of agriculture. Among the subjects deserving notice, may be mentioned the practice of steeping and liming seed corn as a preventive of smut; changing every year the *species* of grain, and bringing seed corn from a distance; ploughing down green crops as manure; and feeding horses with broken oats and chaff. This writer seems to differ a good deal from Blythe about the advantage of interchanging tillage and pasture. "It were no losse to this island," he says, "if that we should not plough at all, if so be that we could certainly have corn at a reasonable rate, and likewise vent for all our manufactures of wool;" and one reason for this is, that pasture employeth more hands than tillage, instead of depopulating the country, as was commonly imagined. The *grout* which he mentions "as coming over to us in Holland ships," about which he desires information, was probably the same with our present shelled barley; and mills for manufacturing it were introduced into Scotland from Holland, towards the beginning of the last century.

To the third edition published in 1655, are subjoined Dr Beattie's Annotations, with the writer of the Legacy's answers; both of them ingenious, and sometimes instructive. But this cannot be said of Gabriel Plattes's *Mercurius Lætificans*, also added to this edition, which is a most extravagant production. There are also several communications from Hartlib's different correspondents; of which the most interesting are those on the early cultivation, and great value of clover. Hartlib himself does not appear much in this collection. But he seems to have been a very useful person in editing the works of others, and as a collector of miscellaneous information on rural subjects. It is strange that neither Blythe nor Hartlib, nor any of Hartlib's correspondents, had ever heard of Fitzherbert's works.

Among the other writers previous to the revolution, we shall only mention Ray the botanist and Evelyn, both men of great talents and research, whose works are still in high estimation. A new edition of Evelyn's *Silva and Terra* was published in 1777 by Dr Hunter, with large notes and elegant engravings, and reprinted in 1812.

Some of the works of the sixteenth and seventeenth centuries are now very scarce, and most of them little known to agriculturists of the present day. In almost all of them there is much that is now useless, and not a little trifling and foolish; yet the labour of perusal is not altogether fruitless. He who wishes to view the condition of the great body of the people during this period, as well as the cultivator who still obstinately resists every new practice, may, each of them, be gratified and instructed, in tracing the gradual progress of improvement, both in enjoyment, and in useful industry. The preceding review commences with a period of feudal anarchy and despotism, and comes down to the time when the exertions of individual interest were protected and encouraged by the firm administration of equal laws; when the prosperity of Great Britain was no longer retarded by internal commotions, nor endangered by hostile invasion.

The laws of this period, in so far as they relate to agriculture and rural economy, display a similar progress in improvement.

From the beginning of the reign of Henry VII. to

the end of Elizabeth's, a number of statutes were made for the encouragement of tillage, though probably to little purpose. The great grievance of those days, was the practice of laying arable land to pasture, and suffering the farm-houses to fall to ruin. "Where, in some towns," says the statute 4th Henry VII. (1488), "two hundred persons were occupied and lived of their lawful labours, now there are occupied two or three herdsmen, and the residue fall into idleness;" therefore it is ordained, that houses which, within three years, have been let for farm, with twenty acres of land, lying in tillage or husbandry, shall be upheld, under the penalty of half the profits to be forfeited to the king or the lord of the fee. Almost half a century afterwards, the practice had become still more alarming; and in 1534, a new act was tried, apparently with as little success. "Some have 24,000 sheep, some 20,000, some 10,000, some 6000, some 4000, and some more and some less;" and yet it is alleged the price of wool had nearly doubled, "sheep being come to a few persons hands." A penalty was therefore imposed on all who kept above 2000 sheep; and no person was to take in farm more than two tenements of husbandry. By the 39th Elizabeth (1597), arable land made pasture since the 1st Elizabeth, shall be again converted into tillage, and what is arable shall not be converted into pasture.

Many laws were enacted during this period against vagabonds, as they were called; and persons who could not find employment seem to have been sometimes confounded with those who really preferred idleness and plunder. The dissolution of the feudal system, and the suppression of the monasteries, necessarily deprived a great part of the rural population of the means of support. They could not be employed in cultivating the soil; for there was no middle class of farmers possessed of capital to be vested in improvements; and what little disposable capital was in the hands of great proprietors, could not, in these rude times, be so advantageously embarked in the expensive and precarious labours of growing corn, as in pasturage, which required much less skill and superintendence. Besides, there was a constant demand for wool on the Continent; while the corn market was not only confined by laws against exportation, but fettered by restrictions on the internal trade. In this state of things, it would have been wiser to have encouraged manufactures, as furnishing the natural outlet to the surplus of the agricultural population, than to have interfered with private interest, under pretence of encouraging husbandry. But, instead of this, the interest of the labouring classes, who were, in some instances, prohibited from going to great cities and becoming artificers, as well as of the proprietors in the management of their estates, were to be sacrificed to the most mistaken views of national policy. The laws regarding the wages of labour, and the price of provisions, are a further proof of the ignorance of the age in matters of political economy, particularly in regard to the proper subjects of legislation.

By the statute 1552, it is declared, that any person that shall buy merchandize, victual, &c. coming to market; or make any bargain for buying the same, before they shall be in the market ready to be sold; or shall make any motion for enhancing the price; or dissuade any person from coming to market; or forbear to bring any

any of the things to market, &c. shall be deemed a *fore-staller*. Any person who buys and sells again in the same market, or within four miles thereof, shall be reputed a *regrater*. Any person buying corn growing in the fields, or any other corn, with intent to sell again, shall be reputed an unlawful *ingrosser*. It was also declared, that no person shall sell cattle within five weeks after he bought them. Licenses, indeed, were to be granted in certain cases, and particularly when the price of wheat was at or under six shillings and eightpence a quarter, and other kinds of grain in that proportion.

The laws regarding the exportation and importation of corn, during this period, could have had little effect in encouraging agriculture, though, towards the latter part of it, they gradually approached that system which was finally established at and soon after the Revolution. From the time of the above mentioned statute against forestallers, which effectually prevented exportation, as well as the freedom of the home trade, when corn was above the price therein specified, down to 1688, there are at least twelve separate enactments on this subject; and some of them are so nearly the same, that it is probable they were not very carefully observed. The price at which wheat was allowed to be exported, was raised from 6s. 8d. a quarter, the price fixed by the 1st and 2d of Philip and Mary (1553), to 10s. in 1623; to 20s. in 1593; to 26s. 8d. in 1604; to 32s. in 1623; to 40s. in 1660; to 48s. in 1663; and at last, in 1670, exportation was permitted without limitation. Certain duties, however, were payable, which in some cases seem to have amounted to a prohibition, and until 1660 importation was not restrained even in years of plenty and cheapness. In permitting exportation, the object appears to have been revenue rather than the encouragement of production.

The first statute for levying tolls at turnpikes, to make or repair roads in England, passed in 1663.

Of the state of agriculture in Scotland in the 16th, and the greater part of the 17th centuries, very little is known; no professed treatise on the subject appeared till after the Revolution. The south-eastern counties were the earliest improved, and yet, in 1660, their condition seems to have been very wretched. Ray, who made a tour along the eastern coast in that year, says "We observed little or no fallow grounds in Scotland; some *ley ground* we saw which they manured with sea wreck. The men seemed to be very lazy, and may be frequently observed to plough in their cloaks. It is the fashion of them to wear cloaks when they go abroad, but especially on Sundays. They have neither good bread, cheese, nor drink. They cannot make them, nor will they learn. Their butter is very indifferent, and one would wonder how they could contrive to make it so bad. They use much pottage made of coalwort, which they call *kail*, sometimes broth of decorticated barley. The ordinary country houses are pitiful cots, built of stone, and covered with turfs, having in them but one room, many of them no chimneys, the windows very small holes, and not

glazed. The ground in the valleys and plains bears very good corn, but especially bears barley or bigge, and oats, but rarely wheat and rye (I)."

It is probable that no great change had taken place in Scotland, from the end of the fifteenth century, except that tenants gradually became possessed of a little stock of their own, instead of having their farms stocked by the landlord. "The minority of James V., the reign of Mary Stewart, the infancy of her son, and the civil wars of her grandson Charles I., were all periods of lasting waste. The very laws which were made during successive reigns, for protecting the tillers of the soil from spoil, are the best proofs of the deplorable state of the husbandman (K)."

Yet in the 17th century were those laws made, which paved the way for the present improved system of agriculture in Scotland. By statute 1633, landholders were enabled to have their tithes valued, and to buy them either at 9 or at 6 years purchase, according to the nature of the property. The statute 1685 conferring on landlords a power to entail their estates, was indeed of a very different tendency, in regard to its effects on agriculture. But the two acts in 1695, for the division of commons, and separation of intermixed properties, have facilitated in an eminent degree the progress of improvement.

From the Revolution to the accession of his present Majesty, the progress of agriculture was by no means so considerable as we should be led to imagine from the great exportation of corn. It is the opinion of well informed writers (L), that very little improvement had taken place, either in the cultivation of the soil, or in the management of live stock, from the Restoration down to the middle of last century. Even clover and turnips, the great support of the present improved system of agriculture, were confined to a few districts, and, at the latter period, were scarcely cultivated at all by common farmers in the northern part of the island. Of the writers of this period, therefore, we shall notice only such as describe some improvement in the modes of culture, or some extension of the practices that were formerly little known.

In Houghton's *Collections on Husbandry and Trade*, a periodical work begun in 1681, we have the first notices of sheep being fed on the ground with turnips. "Some in Essex have their fallow after turnips, which feed their sheep in winter, by which means their turnips are scooped, and so made capable to hold dews and rain water, which, by corrupting, imbibes the nitre of the air, and when the shell breaks, it runs about and fertilizes. By feeding the sheep, the land is dunged as if it had been folded, and those turnips, though few or none be carried off for human use, are a very excellent improvement; nay, some reckon it so, though they only plough the turnips in, without feeding (M)." This was written in February 1694; but ten years before, Worlidge, one of his correspondents, observes, "sheep fatten very well on turnips, which prove an excellent nourishment for them in hard winters, when fodder is scarce; for they will not only eat the greens, but feed on

(I) Select Remains of John Ray. Lond. 1760.

(L) Annals of Agriculture, No. 270, Harte's Essays. Comber on National Subsistence, p. 161.

(M) Houghton's Collections on Husbandry and Trade, Vol. I. p. 213. Edit. 1728.

on the roots in the ground, and scoop them hollow even to the very skin."—"Ten acres," he adds, "sown with clover, turnips, &c. will feed as many sheep as one hundred acres thereof would before have done (N)."

At this time potatoes were beginning to attract notice. "The potato," says Houghton, "is a *bacciferous* herb, with *esulent* roots, bearing winged leaves, and a *bell* flower."

"This, I have been informed, was brought first out of Virginia by Sir *Walter Raleigh*; and he stopping at *Ireland*, some was planted there, where it thrived very well, and to good purpose; for in their succeeding wars, when all the corn above ground was destroyed, this supported them; for the soldiers, unless they had dug up all the ground where they grew, and almost sifted it, could not extirpate them. From thence they were brought to *Lancashire*, where they are very numerous, and now they begin to spread all the kingdom over. They are a pleasant food boil'd or roasted, and eaten with butter and sugar. There is a sort brought from Spain, that are of a longer form, and are more luscious than ours; they are much set by, and sold for sixpence or eightpence the pound (O)."

The next writer is Mortimer, whose *Whole Art of Husbandry* was published in 1706, and has since run through several editions. It is a regular systematic work of considerable merit; and it does not appear that much improvement has been made in the practices he describes, in many parts of Britain. From the third edition of *Hartlib's Legacy*, we learn that clover was cut green, and given to cattle; and it appears that this practice of *soiling*, as it is now called, had become very common about the beginning of last century, wherever clover was cultivated. Rye-grass was now sown along with it. Turnips were hand-hoed, and extensively employed in feeding sheep and cattle, in the same manner as at present.

The first considerable improvement in the practice of that period, was introduced by *Jethro Tull*, a gentleman of *Berkshire*, who began to drill wheat and other crops, about the year 1701, and whose *Horse-hoeing Husbandry* was published in 1731. In giving a short account of the innovations of this eccentric writer, it is not meant to enter into any discussion of their merits. It will not detract much from his reputation to admit, that, like most other men who leave the beaten path, he was sometimes misled by inexperience, and sometimes deceived by a too sanguine imagination. Had *Tull* confined his recommendation of the drill husbandry, to leguminous and bulbous-rooted plants generally, and to the *cereal gramina* only in particular circumstances; and had he, without puzzling himself about the food of plants, been contented with pointing out the great advantage of pulverizing the soil in most cases, and extirpating weeds in every case, he would certainly have deserved a high rank among the benefactors of his country. A knowledge of his doctrines and practice, however, will serve as a necessary introduction to the present approved modes of culture.

Tull's theory is promulgated with great confidence; and in the controversy which he thought proper to maintain in support of it, he scrupled not to employ ridicule

as well as reasoning. Besides the Roman writers *de re rustica*, *Virgil* in particular, whom he treats with high disdain, he is almost equally severe on *Dr Woodward*, *Bradley*, and other writers of his own time.

As the distance between his rows appeared much greater than was necessary for the range of the roots of the plants, *Tull* begins by showing, that these roots extend much farther than is commonly believed; and then proceeds to inquire into the nature of their food. After examining several hypotheses, he decides this to be fine particles of earth. The chief, and almost the only use of dung, he thinks, is to divide the earth; to dissolve "the terrestrial matter which affords nutriment to the mouths of vegetable roots;" and this can be done more completely by tillage. It is therefore necessary, not only to pulverize the soil by repeated ploughings before it be seeded; but as it becomes gradually more and more compressed afterwards, recourse must be had to tillage, while the plants are growing, and this is *Hoeing*; which also destroys the weeds that would deprive the plants of their nourishment.

The leading features of *Tull's* husbandry, are his practice of laying the land into narrow ridges of five or six feet, and upon the middle of these, drilling one, two, or three rows; distant from one another about seven inches when there were three; and ten inches when only two. The distance of the plants on one ridge, from those on the contiguous one, he called an *interval*; the distance between the rows on the same ridge a *space*, or *partition*: the former was stirred repeatedly by the horse-hoe, the latter by the hand-hoe.

The extraordinary attention this ingenious person gave to his mode of culture, is perhaps without a parallel. "I formerly was at much pains," he says, "and at some charge, in improving my drills, for planting the rows at very near distances; and had brought them to such perfection, that one horse would draw a drill with eleven shares, making the rows at three inches and a half distance from one another; and, at the same time, sow in them three very different sorts of seeds, which did not mix; and these too at different depths. As the barley-rows were seven inches asunder, the barley lay four inches deep. A little more than three inches above that, in the same channels, was clover; betwixt every two of these rows was a row of *St Foin*, covered half an inch deep.

"I had a good crop of barley the first year; the next year two crops of broad clover, where that was sown; and where hop-clover was sown, a mixed crop of that and *St Foin*; but I am since, by experience, so fully convinced of the folly of these, or any other mixed crops, and more especially of narrow spaces, that I have demolished these instruments (in their full perfection) as a vain curiosity, the drift and use of them being contrary to the true principles and practice of horse-hoeing (P)."

In the culture of wheat, he began with ridges six feet broad, or eleven on a breadth of 66 feet; but on this he afterwards had fourteen ridges. After trying different numbers of rows on a ridge, he at last preferred two, with an intervening space of about ten inches. He allowed only three pecks of seed for an acre. The first

(N) Houghton's Collections, Vol. IV. p. 142—144.

(P) Horse-Hoeing Husbandry, p. 62. Lond. 1762.

(O) Ib. Vol. II. p. 468.

first hoeing was performed by turning a furrow from the row, as soon as the plant had put forth four or five leaves; so that it was done before, or at the beginning of winter. The next hoeing was in spring, by which the earth was returned to the plants. The subsequent operations depended upon the circumstances and condition of the land, and the state of the weather. The next year's crop of wheat was sown upon the intervals which had been unoccupied the former year; but this he does not seem to think was a matter of much consequence. "My field," he observes, "whereon is now the thirteenth crop of wheat, has shown that the rows may successfully stand upon any part of the ground. The ridges of this field were, for the twelfth crop, changed from six feet to four feet six inches. In order for this alteration, the ridges were ploughed down, and then the next ridges were laid out the same way as the former, but one foot six inches narrower, and the double rows drilled on their tops; whereby, of consequence, there must be some rows standing on every part of the ground, both on the former partitions, and on every part of the intervals. Notwithstanding this, there was no manner of difference in the goodness of the rows; and the whole field was in every part of it equal, and the best, I believe, that ever grew on it. It is now the thirteenth crop, likely to be good, though the land was not ploughed crossways (q)."

It follows from this singular management, that Tull thought a succession of crops of different species altogether unnecessary; and he labours hard to prove against Dr Woodward, that the advantages of such a change, under his plan of tillage, were quite chimerical; though he seems to admit the benefit of a change of the seed itself. But the best method of determining the question would have been, to have stated the amount of his crops per acre, and the quality of the grain, instead of resting the superiority of his management on the alleged saving of expence, when compared with the common broad-cast husbandry.

On the culture of turnip, both his principles and his practice are much more correct. The ridges were of the same breadth as for wheat; but only one row was drilled on each. His management, while the crop was growing, differs very little from the present practice. When drilled on the level, it is impossible, he observes, to hoe-plough them so well as when they are planted upon ridges. But the seed was deposited at different depths, the half about four inches deep, and the other half exactly over that, at the depth of half an inch. "Thus planted, let the weather be never so dry, the deepest seed will come up; but if it raineth immediately after planting, the shallow will come up first. We also make it come up at four times, by mixing our seed, half new and half old, the new coming up a day quicker than the old. These four comings up give it so many chances for escaping the fly; it being often seen, that the seed sown over night will be destroyed by the fly, when that sown the next morning will escape, and vice versa: Or you may hoe-plough them when the fly is like to devour them; this will bury the greatest part of those enemies: Or else you may drill in another row without new-ploughing the land."

Drilling, and horse and hand-hoeing, seem to have been in use before the publication of Tull's book. "Hoeing," he says, "may be divided into deep, which is our horse-hoeing; and shallow, which is the English hand-hoeing; and also the shallow horse-hoeing used in some places betwixt rows, where the intervals are very narrow, as sixteen or eighteen inches.—This is but an imitation of the hand-hoe, or a *succedaneum* to it, and can neither supply the use of dung, nor of fallow, and may be properly called *scratch-hoeing*." But in his mode of forming ridges, his practice seems to have been original; his implements display much ingenuity; and his claim to the title of Father of the present horse-hoeing husbandry of Great Britain seems indisputable. A translation of Tull's book was undertaken at one and the same time in France, by three different persons of consideration, without the privity of each other.—Two of them afterwards put their papers into the hands of the third, *M. Du Hamel du Monceau*, of the Royal Academy of Sciences at Paris, who published a treatise on husbandry, on the principles of Mr Tull, a few years after. But Tull seems to have had very few followers in England for more than thirty years. The present method of drilling and horse-hoeing turnips, was not introduced into Northumberland till about the year 1780 (R); and it was then borrowed from Scotland, the farmers of which had the merit of first adopting Tull's management in the culture of this root about 1760, and from whom it has since made its way, but slowly, in the southern part of the island.

Among the English writers of this period, may be mentioned Bradley, Lawrence, Hales, Miller, Ellis, Smith, Hill, Hitt, Lisle, and Home. Most of their works went through several editions in a few years—at once a proof of the estimation in which they were held, and of the direction of the public mind towards an investigation of the principles and practice of agriculture.

Of the progress of the art in Scotland, till towards the end of the 17th century, we are almost entirely ignorant. The first work, written by Donaldson, was printed in 1697, under the title of *Husbandry Anatomised; or, An Inquiry into the present Manner of Teiling and Manuring the Ground in Scotland*. It appears from this treatise, that the state of the art was not more advanced at that time in North Britain, than it had been in England in the time of Fitzherbert. Farms were divided into *infield* and *outfield*; corn crops followed one another, without the intervention of fallow, cultivated herbage or turnips, though something is said about fallowing the outfield; enclosures were very rare; the tenantry had not begun to emerge from a state of great poverty and depression; and the wages of labour, compared with the price of corn, were much lower than at present; though that price, at least in ordinary years, must appear extremely moderate in our times. Leases for a term of years, however, were not uncommon; but the want of capital rendered it impossible for the tenantry to attempt any spirited improvements.

Donaldson first points out the common management of

(q) Horse-Hoeing Husbandry, p. 424. Lond. 1762.

(R) Northumberland Survey, p. 100.

of that period, which he shows to have been very unproductive; and afterwards recommends what he thinks would be a more profitable course. Of the "dale ground (he says), that is, such lands as are partly hills and partly valleys, of which sorts may be comprehended the greatest part of arable ground in this kingdom, I shall suppose a farmer to have a lease or tack of threescore acres, at three hundred merks of rent per annum (16l. 13s. 4d. sterling). Perhaps some, who are not acquainted with rural affairs, may think this cheap; but those who are the possessors thereof think otherwise, and find difficulty enough to get the same paid, according to their present way of manuring thereof. But that I may proceed to the comparison, I shall show how commonly this farm room is managed. It is commonly divided into two parts, viz. one-third croft, and two-thirds outfield, as it is termed. The croft is usually divided into three parts; to wit, one-third barley, which is always dunged that year barley is sown thereon; another third oats; and the last third pease. The outside field is divided into two parts; to wit, the one-half oats, and the other half grass, two years successively. The product, which may be supposed to be on each acre of croft, four bolls (three Winchester quarters); and that of the outfield, three (two and one-fourth quarters): the quota is seven score bolls, which we shall also reckon at five pounds (8s. 4d.) per boll, cheap year and dear year, one with another. This in all is worth 700l. (58l. 6s. 8d. sterling).

"Then let us see what profit he can make of his cattle. According to the division of his lands, there is twenty acres of grass, which cannot be expected to be very good, because it gets not leave to lie above two years, and therefore cannot be well soarded. However, usually, besides four horses, which are kept for ploughing the said land, ten or twelve nolt are also kept upon a farm room of the above-mentioned bounds; but, in respect of the badness of the grass, as said is, little profit is had of them. Perhaps two or three stone of butter is the most can be made of the milk of his kine the whole summer; and not above two heffers brought up each year. As to what profit may be made by bringing up young horses, I shall say nothing, supposing he keeps his stock good by those of his own up-bringing. The whole product, then, of his cattle, cannot be reckoned above fifty merks (2l. 15s. 6d.). For in respect his beasts are in a manner half starved, they are generally small; so that scarce may a heffer be sold at above twelve pounds (1l. sterling). The whole product of this farm room, therefore, exceeds not the value of 733l. (61l. 1s. 8d. sterling), or thereabout." The labourers employed on this farm, were two men and one woman, besides a herd in summer, and other servants in harvest.

Donaldson then proceeds to point out a different mode of management, which he calculates to be more profitable; but no notice is taken of either clover or turnips, as crops to be raised in his new course, though they are incidentally noticed in other parts of the work.

"I also recommend potatoes, as a very profitable root for husbandmen and others that have numerous families. And because there is a peculiar way of planting this root, not commonly known in this country, I shall here shew what way it is ordinarily planted or

set. The ground must be dry; and so much the better it is, if it have a good soard of grass. The beds or riggs are made about eight feet broad, good store of dung being laid upon your ground; horse or sheep dung is the most proper manure for them. Throw each potato or sett (for they were sometimes cut into setts) into a knot of dung, and afterwards dig earth out of the furrows, and cover them all over, about some three or four inches deep; the furrows left between your riggs must be about two feet broad, and little less will they be in depth, before your potatoes be covered. You need not plant this root in your garden; they are commonly set in the fields, and wildest of ground, for enriching of it." As to their consumption, they were sometimes "boiled and broken, and stirred with butter and new milk; also roasted, and eaten with butter; yea, some make bread of them, by mixing them with oat or barley-mcal; others parboil them, and bake them with apples, after the manner of tarts."

There is a good deal in this little treatise about sheep, and other branches of husbandry; and if the writer was well informed, as in most instances he appears to have been, his account of prices, of wages, and generally of the practices of that period, is very interesting.

The next work on the husbandry of Scotland, is, *The Country Man's Rudiments, or An Advice to the Farmers in East Lothian, how to labour and improve their grounds*, said to have been written by Lord Belhaven, about the time of the Union, and reprinted in 1723. In this we have a deplorable picture of the state of agriculture, in what is now the most highly improved county in Scotland. His Lordship begins with a very high encomium on his own performance. "I dare be bold to say, there was never such a good easy method of husbandry as this, so succinct, extensive, and methodical in all its parts, published before." And he bespeaks the favour of those to whom he addresses himself, by adding, "neither shall I affright you with hedging, ditching, marling, chalking, paring and burning, draining, watering and such like, which are all very good improvements indeed, and very agreeable with the soil and situation of East Lothian; but I know ye cannot bear as yet such a crowd of improvements, this being only intended to initiate you in the true method and principles of husbandry." The farm rooms in East Lothian, as in other districts, were divided into infield and outfield, the former of which got all the dung. "The infield, where wheat is sown, is generally divided by the tenant into four divisions or breaks, as they call them, viz. one of wheat, one of barley, one of pease, and one of oats; so that the wheat is sowed after the pease, the barley after the wheat, and the oats after the barley. The outfield land is ordinarily made use of promiscuously for feeding of their cows, horse, sheep, and oxen: 'tis also dunged by their sheep, who lay in earthen folds; and sometimes when they have much of it, they fauch or fallow a part of it yearly." Under this management, the produce seems to have been three times the seed; and yet, says his Lordship, "if in East Lothian, they did not leave a higher stubble than in other places of the kingdom, their grounds would be in a much worse condition than at present they are, though bad enough.—A good crop of corn makes a good stubble, and a good stubble is the equallest

equallest mucking that is." Among the advantages of enclosures, he observes, "you will gain much more labour from your servants, a great part of whose time was taken up in gathering thistles, and other garbage, for their horses to feed upon in their stables; and thereby the great trampling and pulling up, and other destruction of the corns, while they are yet tender, will be prevented." Potatoes and turnips are recommended to be sown in the yard (kitchen garden). Clover does not seem to have been known. Rents were paid in corn; and, for the largest farm, which he thinks should employ no more than two ploughs, the rent was "about six chalders of victual, when the ground is very good, and four in that which is not so good. But I am most fully convinced they should take long leases or tacks, that they may not be straitened with time in the improvement of their rooms; and this is profitable both for master and tenant."

Such was the state of the husbandry of Scotland in the early part of last century. The first attempts at improvement cannot be traced farther back than 1723, when a number of landholders formed themselves into a *Society of Improvers in the knowledge of Agriculture in Scotland*. The earl of Stair, one of their most active members, is said to have been the first who cultivated turnips in that country. The Select Transactions of this Society were collected and published in 1743, by Mr Maxwell, who took a large part in its proceedings. It is evident from this book, that the Society had exerted itself in a very laudable manner, and apparently with considerable success, in introducing cultivated herbage and turnips, as well as in improving on the former methods of culture. But there is reason to believe, that the influence of the example of its members, did not extend to the common tenantry, who are always unwilling to adopt the practices of those who are placed in a higher rank, and supposed to cultivate land for pleasure, rather than profit. Though this Society, the earliest probably in the united kingdom, soon counted upwards of three hundred members, it existed little more than twenty years. Maxwell delivered lectures on agriculture for one or two sessions at Edinburgh, which, from the specimen he has left, ought to have been encouraged.

In the introductory paper in Maxwell's Collection, we are told, "that the practice of draining, enclosing, summer-fallowing, sowing flax, hemp, rape, turnip, and grass seeds; planting cabbages after, and potatoes with, the plough, in fields of great extent, is introduced; and that, according to the general opinion, more corn grows now yearly where it was never known to grow before, these twenty years last past, than perhaps a sixth of all that the kingdom was in use to produce, at any time before."

In this work, we find the first notice of a thrashing machine; it was invented by Mr Michael Menzies, advocate, and he obtained a patent for it. Upon a representation made to the Society, that it was to be seen going in several places, they appointed two of their number to inspect it; and in their report they say, that one man would be sufficient to manage a machine which would do the work of six. One of the machines was "moved by a great water wheel and triddles;" and another, "by a little wheel of three feet diameter, moved by a small quantity of water." This machine,

the Society recommended to all gentlemen and farmers.

The next work is by the same Mr Maxwell, printed in 1757, and entitled the *Practical Husbandman: being a collection of miscellaneous papers on Husbandry, &c.* In this book, the greater part of the Select Transactions is republished, with a number of new papers, among which, an *Essay on the Husbandry of Scotland*, with a proposal for the improvement of it, is the most valuable. In this he lays it down as a rule, that it is bad husbandry to take two crops of grain successively, which marks a considerable progress in the knowledge of modern husbandry; though he adds, that in Scotland, the best husbandmen after a fallow take a crop of wheat; after the wheat, pease; then barley, and then oats; and after that they fallow again. The want of enclosures was still a matter of complaint. The ground continued to be cropped so long as it produced two seeds: the best farmers were contented with four seeds, which was more than the general produce.

The first act of parliament for collecting tolls on the highway in Scotland, was passed in 1750, for repairing the road from Dunglass bridge to Haddington. In ten years after, several acts followed for the counties of Edinburgh and Lanark, and for making the roads between Edinburgh and Glasgow. The benefit which agriculture has derived from good roads, it would not be easy to estimate. The want of them was one great cause of the slow progress of the art in former times.

The Revolution in 1688 was the epoch of that system of Corn Laws, to which very great influence has been ascribed, both on the agriculture and general prosperity of the country. In 1670, exportation was permitted, whatever the price might be; and importation was virtually prohibited, by a duty of 16s. per quarter, when wheat did not exceed 53s. 4d.; of 8s. when above that, and not exceeding 80s.; and, when above 80s., the duty of 5s. 4d., imposed by the act 1663, continued to be payable. Still, however, as there was a duty payable on exportation; and as importation, from some defect in the law respecting the mode of ascertaining the prices at which the different duties were exigible, still continued at the low duty, the system by which exportation was encouraged, and importation in ordinary cases prohibited, was not completely established till 1688 and 1700. In the former of these years, a bounty of 5s. a quarter was given on exportation, when the price of wheat did not exceed 48s.; and in the latter, the duties on exportation were wholly repealed. Under these laws, not only was the excess of exports very considerable, but the prices of grain, down to 1765, were much lower than during an equal number of years preceding 1688. This is not the place to inquire how far these laws had an influence in producing this phenomenon; but the facts themselves are indisputable. Yet the mere circumstance of large exportations of grain does by no means prove the prosperity of agriculture; far less is its cheapness in the home markets any evidence of the comfortable subsistence of the lower orders. Corn seems to have been raised in such abundance, not merely because the market was extended by means of the bounty, but because there was little demand for other products of the soil, which have, since that time, withdrawn a large portion of the best arable land from the growth of corn. And the price

price was low, because neither the number nor wealth of the consumers had increased in a proportion corresponding to the supply. Before the accession of his present Majesty, the number of acts for enclosure was only two hundred and forty-four;—a clear proof that agricultural improvements proceeded much more slowly than they have done since. And it cannot be disputed, that, owing to the imperfect culture of that period, when ameliorating crops did not enter largely into the courses of management, any given extent of land did not produce so much corn, as under the improved rotations of modern husbandry.

The exportation of wool was prohibited in 1647, in 1660, and in 1688; and the prohibition strictly enforced by subsequent statutes. The effect of this on its price, and the state of the wool trade, from the earliest period to the middle of last century, are distinctly exhibited by the learned and laborious author of *Memoirs on Wool*, printed in 1747.

The gradual advance in the price of land produce, soon after the year 1760, occasioned by the increase of population, and of wealth derived from manufactures and commerce, has given a more powerful stimulus to rural industry, augmented agricultural capital in a greater degree, and called forth a more skilful and enterprising race of cultivators, than all the laws for regulating the corn trade could ever have effected. Most of the inventions for increasing produce and economizing labour, have either been introduced, or improved and greatly extended since that time; and by means of both, the free surplus has been vastly increased for the supply of the general consumption. The passing of more than 3000 bills of enclosure, in the present reign, is a proof how much more rapidly the cultivation of new land has proceeded than in the former period; and the garden-like appearance of the country, as well as the striking improvement in the condition of all classes of the rural population, display, in the most decided manner, the skill and the success with which this great branch of national industry is now followed throughout the greater part of Britain.

In a view of the progress of husbandry, any considerable improvements in the species of crops cultivated, and the order in which they succeed one another, in agricultural machinery, and in the kinds and varieties of live stock, are entitled to hold a very prominent place. But our limits do not permit us to do more, than just to notice a few of the most important. Besides that they are too recent, and, in general, too well known to require any particular description, all the most valuable discoveries, and the most beneficial practices of this period, have been explained with sufficient minuteness in the numerous agricultural works that have lately issued from the press; and most of them in the pages of this journal.

The *swing plough*, improved by Small, the *thrashing machine*, brought to perfection by Meikle, and the *reaping machine*, now in a very promising state, by far the most important inventions in agricultural machinery, must be already well known to our readers.

The great line of distinction between the present and the former courses of cropping, consists in the alternation of what are called exhausting and ameliorating crops. The best cultivators rarely take two corn crops in succession; but a culmiferous crop is almost

universally succeeded, in all well cultivated districts, by a leguminous crop, or one of herbage, cut or pastured, or turnips, cabbages, rape, &c.; or when the soil is unsuited to turnips, by a summer fallow, recurring at as distant an interval as the state of the soil, in regard to cleanness will permit. In common language, a green or a pulse crop, or a plain fallow, is interposed between every two white corn crops. These green crops not only preserve the fertility of the soil, but, when sown in rows, as most of them usually are, they afford an opportunity of extirpating weeds, by the use of the horse and hand hoe; and even when sown broadcast, by their complete possession of the ground, if it is properly prepared, the growth of weeds is effectually checked. In other respects, these intermediate crops are of the utmost importance in every good course of management. Whether they be eaten on the ground, or carried to the farm-houses and straw-yards, much valuable manure is obtained from their consumption; and on sandy or gravelly soils, when only a part of a turnip crop is eaten by sheep on the ground, the greatest defect of such land is removed by their treading; and, in many cases, rendered capable of producing as valuable a crop of wheat as soils of a closer texture. It is for these reasons, that by the cultivation of clover and turnips in particular, in regular alternation with corn, the soil is so much enriched, as to yield as much corn on one half of any given extent of land, as the whole did under the old course of successive crops of corn; and, unless upon strong clays, an unproductive fallow is wholly dispensed with.

But these crops are not less valuable in another point of view. Before the introduction of clover and turnips, there was nothing for the maintenance of live stock, but natural herbage in summer, with the addition of coarse hay and straw in winter; and in the northern parts of the island in particular, where the winters are long and severe, it was seldom possible to do more, for about half the year, than preserve cattle and sheep from starving. Even in the most favourable situations, very little butcher's meat could be brought to market from December to June, unless at an expense which the great body of consumers were quite unable to reimburse. The more early maturity of cattle and sheep, and the regular supply of the market throughout the year, are therefore chiefly owing to turnips and clover; as well as the vast increase in the number of the live stock kept on arable land, and the great degree of perfection to which some breeds have been brought, by the skilful experiments of several eminent agriculturists.

Among these, the first place is unquestionably due to Mr Robert Bakewell of Dishley, in Leicestershire. By his skilful selection at first, and constant care afterwards to breed from the best animals, without any regard to their consanguinity, he at last obtained a variety of sheep, which, for early maturity, and the property of returning a great produce of mutton for the food they consume, as well as for the small proportion which the weight of the offal bears to that of the four quarters, are altogether unequalled either in this or any other country. The Dishley or New Leicester sheep, and their crosses, are now spread over the principal corn districts of Britain; and, from their quiet domesticated habits, are probably still the most profitable

profitable of all the varieties of sheep, on farms where the rearing and fattening of live stock are combined with the best courses of tillage crops.

The practice of Mr Bakewell and his followers, furnishes an instance of the benefits of a division of labour in a department of business where it was little to be expected. Their males were let out every year to breeders from all parts of England; and thus, by judiciously crossing the old races, all the valuable properties of the Dishley variety descended, after three or four generations, to their posterity. By no other means could this new breed have spread so rapidly, nor have been made to accommodate itself so easily to a change of climate and pasture. Another recommendation of this plan was, that the ram-hirer had a choice among a number of males, of somewhat different properties, and in a more or less advanced stage of improvement, from which it was his business to select such as suited his particular object. These were reared by experienced men, who gave their principal attention to this branch alone; and having the best females as well as males, they were able to furnish the necessary supply of young males in the greatest variety, to those farmers whose time was occupied with other pursuits. The prices at which Mr Bakewell's rams were hired, appear enormous. In 1789, he received twelve hundred guineas for the hire of three brought at one birth; two thousand for seven; and, for his whole letting, at least three thousand guineas.

Merino sheep were first brought into England in 1788, when his Majesty procured a small flock by way of Portugal. In 1791, another flock was imported from Spain. In 1804, when his Majesty's annual sales commenced, this race began to attract much notice. Dr Parry of Bath has crossed the Ryeland or Herefordshire sheep with the Merinos, and brought the wool of the fourth generation to a degree of fineness not excelled by that of the pure Merino itself; while the carcase, in which is the great defect of the Merinos, has been much improved. Lord Somerville, and many other gentlemen, have done themselves much honour by establishing this race, so necessary to the prosperity of our woollen manufactures, and in removing its defects by their judicious management.

One of the most valuable plants, introduced into cultivation since 1760, is the *ruta-baga* or Swedish turnip, which in some degree supplies the great desideratum of late spring food for live-stock, after the common turnip is generally much damaged, and sometimes almost wholly destroyed, by the severity and changes of the weather. The Scotch yellow turnip is for the same reason a most useful variety, coming in between the white turnips and the Swedish, in some situations supplying the place of the latter, and yielding generally a larger produce.

A variety of oats, called the *potato oat*, was accidentally discovered in Cumberland in 1788. It comes early, and gives a large produce both in grain and in meal, on good soils. It has spread over all the north of England and south of Scotland, and is now almost the only kind sown on many of the best farms. But it has already begun to degenerate. A great many varieties of summer wheat have been introduced of late, but they are only partially cultivated.

In 1765, the corn laws established in the end of the

17th century began to be repealed, and exportation was prohibited, and importation permitted, without payment of duties, by annual acts, during the seven subsequent years. A new system was established in 1773, allowing importation, when the price of wheat was at or above 48s. per quarter, at the low duty of 6d. Exportation was prohibited when the price was 44s.; and below that, the former bounty of 5s. per quarter continued to be payable.

By the act 1791, the bounty on exportation, when the price was under 44s. per quarter, remained unaltered; but exportation was permitted till the price was 46s. Importation was virtually prohibited by high duties when the price was below 50s., and permitted on payment of a duty of 6d. when at or above 54s.

In 1804, the corn laws were altered for the third time, and the bounty on exportation was paid till the price of wheat was 48s. per quarter; and at 54s. exportation was prohibited. The high duty of 24s. 3d. was payable on importation till the price was 63s.; above 63s. and under 66s., a duty of 2s. 6d.; and above 66s. the low duty of 6d. By an act in 1805, importation into any part of Britain is to be regulated by the aggregate average price of the twelve maritime districts of England. Importation was never stopt under the law of 1804, till February 1815.

During the last twenty-two years, about 60 millions of pounds sterling have been paid for foreign grain. In bad seasons, the prices have been enhanced to a most alarming degree, notwithstanding large bounties have been paid on importation. The average price of every successive period of ten years, since 1765, has risen considerably; and since 1795, the price has been seldom less than double the average of the first 60 years of the last century.

The corn laws, after much discussion in Parliament, a very general opposition on the part of the manufacturing and commercial classes, with a great number of publications on both sides, have recently undergone another change, which will probably be not more lasting than those that have preceded it. By the 54th of the king, ch. 69. (17th June 1814) the exportation of corn, meal, malt and flour, from any part of the united kingdom, is permitted at all times, without payment of any duty, or receiving any bounty; and by the 55th, ch. 26. (23d March 1815) importation is altogether prohibited (except for the warehouse, from whence it may be taken out for sale, when the prices are such as would permit importation) till the price of wheat is 80s.; rye, pease and beans, 53s.; barley, bear or bigg, 40s.; and oats 27s. per quarter. Above these prices, these different kinds of corn are admitted, without payment of any duty whatever. From the British colonies in America, corn may be imported for home-consumption, without payment of any duty, when the prices are at or above—wheat, 67s.; rye, pease, and beans, 44s.; barley, bear or bigg, 33s.; and oats, 22s. per quarter.

Almost all the restrictions on the inland corn trade, were removed by the act 1772; and the more just views of the present age have given freedom to the trade, in point of fact, though some of the old laws against forestalling, &c. are still unrepealed. Yet it is not many years since punishments were inflicted for these imaginary crimes.

The agriculture of Scotland has been greatly benefit-

ed by an act in 1770, which relaxed the rigour of strict entails, and extended the powers of proprietors, in so far as regards the improvement of their estates, and the granting of leases.

There is nothing that shows more clearly the rapid progress of agriculture in Britain, than the great number of societies that have been lately formed, one or more in almost every county, for the diffusion of knowledge, and the encouragement of correct operations and beneficial discoveries. We have already noticed the society of improvers, established in Scotland in 1723. Besides those respectable associations, which have for their object the encouragement of arts, manufactures, and commerce, generally, several large institutions have been formed, whose chief purpose is the improvement of agriculture. Among these, the *Bath and West of England Society*, established in 1777, and the *Highland Society of Scotland*, in 1784, hold a conspicuous rank; and the establishment of the Board of Agriculture, in 1793, ought to form a new era in the history of the agriculture and rural economy of Britain. The reports of the different counties, many of them surveyed a second time, and now reprinted, according to an uniform plan, have been followed by the *General Report of the Agricultural State and Political Circumstances of Scotland*; and a similar work for England is understood to be in the contemplation of the Board.

A great many excellent works on agriculture and relative subjects, have been published since 1760; and, among these, several periodical ones have been very favourably received, and widely circulated. But as they are comparatively recent, and the best of them well known, it is unnecessary to give any particular account, either of their merits or defects.

Within the last six years, the agriculture of Britain has experienced a shock, from which it cannot recover for a much longer period. In that time, the loss of capital, owing to the extraordinary depression of almost all sorts of land produce, cannot have been less than one year's rental of the whole island. The replies sent to the circular letter of the Board of Agriculture, regarding the agricultural state of the kingdom, in February, March, and April last, furnish a body of evidence which cannot be controverted, and exhibit a picture of widely spread ruin among the agricultural classes, and of distress among all that immediately depend upon them, to which there is probably no parallel. This is not the place to inquire into the causes of this melancholy reverse; but it will not readily be ascribed, by those who are best acquainted with the subject, either to the uncommon fertility of the seasons, or a too extensive cultivation.

About the year 1600, France made some considerable efforts to revive the arts of husbandry, as appears from several large works, particularly *Les Moyens de devenir Riche*; and the *Cosmopolite*, by Bernard de Palissy, a poor porter, who seems to have been placed by fortune in a station for which nature never intended him; *Le Theatre d'Agriculture*, by Defferres; and *L'Agriculture et Maison Rustique*, by Messrs Etienne, Liebault, &c.

Nearly in the same period, the skilful practice of husbandry became more prevalent among this people and the Flemings than the publishing of books on the subject. Their intention seemed to be that of carrying

on a private lucrative employment, without instructing their neighbours. Whoever therefore became desirous of copying their method of agriculture, was obliged to visit that country, and make his own remarks on their practice.

The principal idea they had of husbandry was, by keeping the lands clean and in fine tilth, to make a farm resemble a garden as nearly as possible.

Such an excellent principle, at first setting out, led them of course to undertake the culture of small farms only, which they kept free from weeds, continually turning the ground, and manuring it plentifully and judiciously. When they had by this method brought the soil to a proper degree of cleanliness, health, and sweetness, they chiefly cultivated the more delicate grasses, as the surest means of obtaining a certain profit upon a small estate, without the expence of keeping many draught horses and servants. A few years experience was sufficient to convince them that ten acres of the best vegetables for feeding cattle, properly cultivated, would maintain a larger stock of grazing animals than forty acres of common farm grass on lands badly cultivated. They also found, that the best vegetables for this purpose were lucerne, saintfoin, trefoil of most kinds, field turnips, &c.

The grand political secret of their husbandry, therefore, consisted in letting farms on improvement. They are said also to have discovered nine sorts of manure; but what they all were, we are not particularly informed. We find, however, that marl was one of them; the use and virtues of which appear also to have been well known in this kingdom two hundred years ago, although it was afterwards much neglected. They were the first people among the moderns who ploughed in green crops for the sake of fertilizing the soil; and who confined their sheep at night in large sheds built on purpose, the floors of which were covered with sand or virgin earth, &c. which the shepherd carted away each morning to the compost dunghill.

After the peace of Aix-la-Chapelle, most of the nations of Europe, by a sort of tacit consent, applied themselves to the study of agriculture, and continued to do so, more or less, amidst the universal confusion that succeeded.

The French found, by repeated experience, that they could never maintain a long war, or procure a tolerable peace, unless they could raise corn enough to support themselves in such a manner as not to be obliged to submit to harsh terms on the one hand, or to perish by famine on the other. This occasioned the king to give public encouragement to agriculture, and even to be present at the making of several experiments. The great, and the rich of various ranks and stations, followed his example; and even the ladies were candidates for a share of fame in this public-spirited and commendable undertaking.

During the hurry and distresses of France in the war of 1756, considerable attention was paid to agriculture. Prize questions were annually proposed in their rural academies, particularly those of Lyons and Bourdeaux; and many judicious observations were made by the Society for improving agriculture in Brittany.

After the conclusion of that war in 1763, matters were carried on there with great vigour. The university of Amiens made various proposals for the advancement

advancement of husbandry; and the marquis de Tourbilly (a writer who proceeded chiefly on experience) had the principal direction of a georgical society established at Tours.

The society at Rouen also deserves notice; nor did the king and his ministers think it unworthy their attention. There soon existed about fifteen societies in France, established by royal approbation, for the promoting of agriculture; and these had twenty co-operating societies belonging to them.

About this time vigorous exertions began to be made in Russia to introduce the most approved system of husbandry which had taken place in other parts of Europe. The late empress sent several gentlemen into Britain and other countries to study agriculture, and gave it all possible encouragement in her own dominions.

The art of agriculture has also been for many years publicly taught in the Swedish, Danish, and German universities, where the professors may render effectual service to their respective countries, if they understand the practical as well as the speculative part, and can converse with as much advantage with the farmer as with Virgil and Columella.

Even Italy has not been totally inactive. The Neapolitans of this age have condescended to recur to the first rudiments of revived husbandry, and begun to study anew the Agricultural System of Crescenzo, first published in 1478. The people of Bergamo have pursued the same plan, and given a new edition of the *Ricordo d'Agricoltura* de Tarello, first published in 1577. The duchy of Tuscany has imbibed the same spirit of improvement. A private gentleman, above 40 years since, left his whole fortune to endow an academy of agriculture. The first ecclesiastic in the duchy was president of this society, and many of the chief nobility were members.

His Sardinian majesty also sent persons to learn the different modes of practice in foreign countries; and made some spirited attempts to establish a better method of agriculture among his subjects.

In Poland also M. de Bieluski, grand marshal of the crown, made many successful attempts to introduce the new husbandry among his countrymen; and procured the best instruments for that purpose from France, England, and other parts of Europe.

The Hollanders are the only people now in Europe who seem to look upon agriculture with indifference. Except the single collateral instance of draining their fens and morasses, they have scarcely paid any attention to it; and even this seems to have proceeded more from the motive of self-preservation, than any love of, or disposition to, husbandry.

In the year 1759, a few ingenious and public-spirited men at Berne in Switzerland established a society for the advancement of agriculture and rural economics. In that society were many men of great weight in the republic, and most of them persons of a true cast for making improvements in husbandry, being enabled to join the practice with the theory.

Nor must we here omit to mention, that the justly celebrated Linnaeus and his disciples have performed great things in the north of Europe, particularly in discovering new kinds of profitable and well-tasted food for cattle. About the same time, Sweden bestowed

successful labours on a soil which had before been looked upon as cold, barren, and incapable of melioration. Of this the Stockholm Memoirs will be a lasting monument.

Denmark, and many of the courts in Germany, followed the same example. Woollen manufactures were encouraged, and his Danish majesty sent three persons into Arabia Felix to make remarks, and bring over such plants and trees as would be useful in husbandry, building, and rural affairs.

The duchy of Wirtemberg, also, a country by no means unfertile, but even friendly to corn and pastureage, has contributed its assistance towards the improvement of agriculture, having more than 50 years since published 14 economical relations at Stutgard.

Neither must we forget the very assiduous attention of the learned in Leipsic and Hanover to this important object. During the rage and devastation of a long war, they cultivated the arts of peace; witness the *Journal d'Agriculture* printed at Leipsic, and the *Recueils d'Hanover* printed in that city.

Even Spain, constitutionally and habitually inactive on such occasions, in spite of all their natural indolence, and the prejudices of bigotry, invited Linnaeus, with the offer of a large pension, to superintend a college founded for the purpose of making new inquiries into the history of nature and the art of agriculture.

Among the Japanese, agriculture is in great repute; and among the Chinese it is distinguished and encouraged by the court beyond all other sciences. The emperor of China yearly, at the beginning of spring, goes to plough in person, attended by all the princes and grandees of the empire. The ceremony is performed with great solemnity; and is accompanied with a sacrifice, which the emperor, as high-priest, offers to Chang-Ti, to ensure a plentiful crop in favour of his people.

But, without any improper partiality to our own country, we are fully justified in asserting, that Britain alone exceeds all modern nations in husbandry; and from the spirit which for the last twenty years has animated many of our nobility and gentry, to become the liberal patrons of improvement, there is reason to hope that this most useful of arts will in a few years, be carried to a greater pitch of perfection than it has ever yet attained in any age or country.—The Royal Society, the Bath Society, and the Society of Arts, &c. in particular, have been signally useful in this respect; and the other associations, which are now established in many parts of the kingdom, co-operate with them in forwarding their laudable design.

It is not, however, to the exertion of public societies, excellent and honourable as they are, that all our modern improvements in agriculture owe their origin. To the natural genius of the people have been added the theory and practice of all nations in ancient and modern times. This accumulated mass of knowledge has been arranged, divided, and subdivided; and after passing the test of practical experiments, the essential and most valuable parts of it have been preserved, improved, and amply diffused in the works of Lord Kames, Mr Young, Stillingfleet, Dr Hunter, Anderson, Dickson, Ellis, Randal, Lisle, Marshal, Mortimer, Duhamel, Bradley, Kent, Mills, and a few other writers upon

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this great art of rendering mankind happy, wealthy, and powerful.

We also remark with much satisfaction, that the British government has of late years thought fit to render the improvement of agriculture an object of public attention and encouragement, by the institution of a *Board of Agriculture*.—About the year 1790, Sir John Sinclair, Bart. invited the clergy of the church of Scotland to transmit to him descriptions of the state of their different parishes, with a view to the publication of what is called a *Statistical Account of Scotland*. The whole members of this body having readily complied with his request, a work in 20 volumes octavo was compiled from the materials afforded by them, containing an account of the agriculture, manufactures, and population of the country. The same gentleman, about that period, was also active in obtaining the institution of a private society, called *The British Wool Society*, which was very successful in calling the attention of the public to the improvement of that important article of national growth and manufacture. By these patriotic exertions, having acquired a considerable share of popularity, he was encouraged on 15th May 1793, to make a motion in the house of commons, of which he was a member, for an address to the crown, recommending the institution of a board of agriculture. The chancellor of the exchequer, Mr Pitt, on perceiving that the proposal was acceptable to the majority of the house, gave it a decided support, and on the 17th May, to which the debate had been adjourned, the motion was carried for an address to his majesty to institute such a board, at an expence not exceeding 3000l.—In consequence of this application, a charter passed the

great seal, incorporating the members of administration for the time, with the archbishops of Canterbury and York, and all their successors in office, together with certain other noblemen and gentlemen, into a board or society, by the name of the *Board or Society for the encouragement of Agriculture and internal improvement*, under the patronage of the crown; with power to the members to elect office-bearers and successors to themselves: and in the mean time Sir John Sinclair was appointed to be the first president, to continue in office till 25th March following; Sir John Caul, Bart. was appointed to be the first treasurer, and Arthur Young, Esq. so well known for his agricultural publications, was appointed secretary.

The regular sittings of the board did not commence till 23d January 1794, since which time it has continued to exert a very considerable degree of activity in establishing an extensive foreign correspondence, and in procuring and publishing every kind of useful domestic agricultural intelligence, some specimens of which we shall afterwards have occasion to notice. This board, soon after its institution, also employed persons of known reputation to prepare agricultural surveys of every county in the island of Great Britain.—Many of these surveys have been published, and form treatises upon this important art, which, for extent of intelligence and ability of execution, have not been exceeded in any age or country. The board has also obtained parliamentary rewards to some individuals for important discoveries, and has offered premiums for essays or treatises upon subjects connected with the purpose of its institution, which have produced a great variety of valuable and ingenious disquisitions.

THEORY OF AGRICULTURE.

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fective.

IN an art that is so necessary to mankind, and that has been so universally practised, it might perhaps be expected, that the principles upon which its operations depend, would have been by this time completely and accurately investigated, and consequently that a correct theory of agriculture could easily be exhibited. This, however, is by no means the case; and it is not a little singular, that, in this most useful of all arts, the theory should still be more defective than in almost any science with which we are acquainted. It is fortunate, however, for the human race, that in most cases, or at least in all important arts, they succeed better in practice than in speculation. During many ages, various artists were accustomed to extract the most ordinary, but most useful metals, from the state of ore or earth in which nature produces them, and to reduce them back from their metallic form and lustre, to a state of ore or earth again. These artists were unacquainted with the principles upon which the success of their operations depended; and it is only within these few years that some ingenious chemists have successfully investigated the nature of these processes, and have explained what they have called the oxygenation and disoxygenation of metals. The same thing has happened in agriculture. Men have often cultivated the ground well, while they have speculated ill concerning the mode of doing so.

Various reasons render it still more difficult to form

a complete theory of agriculture, than of chemistry, mechanics, or other arts. In agriculture, an experiment cannot be made in an instant, or even in an hour, or in a day or two. A whole season must pass away before a single experiment can be performed, and after all, as in other arts, the inquirer after truth may be misled by some unobserved circumstances. Some fact, quite foreign to the experiment itself, arising out of the peculiar state of the soil, or of the train of seasons, may produce plentiful crops for a year or two, though, in ordinary circumstances, no such effect would follow: and the ingenious contriver of the experiment, who thought he had made an important discovery, may afterwards derive from it only disappointment and mortification. But human life is too short to admit a very great variety of agricultural experiments to be performed by the same individual. After a few seasons, he must leave his place to be occupied by a new inquirer, possessed of a different character and of different views. Unfortunately, till of late years, it was not usual for husbandmen to publish, and thus to immortalize and diffuse over whole nations, the result of their private experience and reflections. Scattered over the face of great countries, and having little intercourse with foreigners, or even with each other, they knew little of what was done by men engaged in the same profession, though at no great distance.—In this way, the benefit

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Vegetables of local discoveries was not communicated to the world at large, nor was an opportunity afforded of eradicating local prejudices and erroneous practices. As the state of this valuable profession is now rapidly altering in these respects, there is little doubt that we are fast approaching towards a period at which it will be possible to exhibit a clear and correct theory of agriculture, or to arrange under a few simple heads the rules or principles upon which the practice of the art depends.—What we are now to offer, is not to be considered as perfect, nor even as possessing any near approximation towards a perfect theory of the husbandman's art; but merely, such a general statement of its principles as results from the degree of information hitherto collected upon the subject.

A theory, or general view of the principles of agriculture seems necessarily to resolve itself into the two following investigations: 1st, To inquire, among the great variety of vegetables that exist in nature, what particular plants ought to be regarded as most worthy of cultivation: and 2dly, To consider the best mode of cultivating with success the plants thus selected.

With regard to the first of these divisions of the subject, or the vegetables that ought to be chosen as most valuable and worthy of cultivation, it may be observed, that the value of a plant is of two kinds, *absolute*, or *relative*: The *absolute* value of a plant depends upon its fitness to afford subsistence to the human species, whereas its *relative* value consists of the tendency which the cultivation of it will have to enrich a particular husbandman, or class of husbandmen, either because their lands are well adapted for its growth, or because there is a ready market for it in the vicinity, where it bears a high price.

Concerning the absolute value of plants, or their tendency to afford subsistence to mankind, it is to be observed, that some plants are *directly* useful or valuable, because they are immediately consumed as food by man, such as wheat, oats, or potatoes; whereas mankind derive subsistence from another class of plants, only in an *indirect* manner, by giving them to cattle, and afterwards eating the flesh of these cattle, as happens with regard to grass and straw of all kinds.

SECT. I. Of Vegetables to be cultivated as Food for Man.

SOME vegetables afford subsistence to the human species by means of the fruit that grows upon them, which hangs, and is brought to maturity in the air, at the summit of their stems. Other vegetables derive their value from producing roots, which come to maturity in the bosom of the soil, and are dug from thence to be consumed by mankind.

Of fruit-bearing vegetables, those called trees, which rise aloft with a strong trunk, are the most permanent and remarkable. It is said that a spot of ground, occupied by some kinds of trees, such as chesnuts or dates, is capable of producing a very great portion of food, useful for the support of the human species. One advantage attending the cultivation of such vegetables, would be that, after the trees are planted, and secured by fences for a few years against animals, they would for ever after, or at least for many years, continue to grow and flourish without care or labour. It does not appear,

however, that in any nation of ancient or modern times, forests of fruit-bearing trees have been reared with a view to afford subsistence to the community. For this two reasons may be assigned. In the first place, a considerable number of years must elapse, before such plants could arrive at maturity, and fulfil the purpose of their destination. Of whatever use therefore they might be to future ages, it is evident that they could afford little benefit to the generation which planted them. But in a question about subsistence, mankind are usually under the necessity of considering their own immediate wants, and hence they have been led to the cultivation of such plants, as afford the most speedy reward for the efforts of their industry. Another reason for preferring the culture of small annual plants, to the greater and more permanent productions of nature, would arise, in the early ages of the world, from the turbulent state of society and the frequency of wars. A community that should depend for its subsistence upon the fruit of forest trees, might be ruined for half a century by the inroad of an enemy. An example of this was exhibited in the war between Great Britain and her North American colonies. When the parent state hired the savages on the western frontier, to join her party, and to make inroads upon the colonists, the latter retaliated upon the savages in the following manner. Several of the colonies united in sending an expedition against the Indians. The bodies of militia employed upon this expedition, were surprised to find small corn fields around a considerable number of the Indian hamlets. They were not satisfied however with destroying the huts of the natives, and these incipient efforts of savage industry; but they anxiously sought out and destroyed every fruit-bearing tree that they found in their progress of almost a thousand miles, thereby rendering the wilderness utterly uninhabitable to a people destitute of agriculture, and who could not always depend for subsistence upon their success in hunting. From this example we see that the frequent wars arising from the barbarous character of ancient nations, would compel them to seek subsistence, not from the fruit of forest trees, but from grain, which speedily arrives at maturity, and which when destroyed can soon be renewed. Thus war becomes a less wasteful scourge to the human race, and communities are enabled speedily to recover from the devastation which it produces. Had the nations of Europe depended for subsistence, upon any fruits which could not be speedily restored when destroyed, it is evident, that, in the late sanguinary conflict, the greater number of them must have been irretrievably ruined.

Hence it appears that the cultivation of plants of annual growth, as a source of subsistence, is favourable to the permanence of civilization in the world; and that before nations can venture to rely for their subsistence upon the fruit of plants of slower growth, their character must have arrived at a degree of moral amelioration far superior to what it has ever been known to possess.

Of annual plants cultivated for fruit, wheat has always been accounted the most valuable. This has probably arisen from the extreme facility with which the flour of it undergoes a process of fermentation, which renders it capable of becoming a more light and agreeable kind of bread than the flour of any other grain. This quality is believed to arise from a quantity of a substance contained in wheat that is of the same nature

Men rather trust to grain.

Vegetables
Food for
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with the gluten, or glue, that is prepared from animal bodies. In other respects, however, it does not appear that wheat is more valuable than some other kinds of grain; by means of long boiling, a given weight of barley, or even of oats, will render a quantity of water as thick or full of mucilage as can be done by the same weight of wheat.

19
Oats a valuable grain.

After wheat, oats have in our country been considered as of very great importance. It is a hardy and beautiful plant; grows with little cultivation, and is particularly well suited for lands newly brought in from a state of nature, upon which it was always used as the first crop, till the introduction of the turnip husbandry. The meal of it is usually very coarsely grinded, and mixed with a considerable quantity of the inner covering of the grain. Hence it has always a considerable degree of roughness, and is harsh, and unsuited to very delicate constitutions; but this very harshness, from its stimulant effect, producing a feeling of warmth in the stomach, renders it more grateful to persons much exposed to the open air, and accustomed to hard labour, who account it a hearty kind of food. Essentially, and in its intrinsic qualities, this grain differs little from some others.

20
Barley valuable from its easy conversion to a saccharine substance.

Barley is chiefly valued in consequence of the facility with which it produces a great quantity of saccharine matter by the process of vegetation or malting, which fits it for the preparation of vinous or spirituous liquors. Pease are also sometimes used when grinded into meal as an article of human food; but on account of their viscid and indigestible quality, they can never become valuable in that point of view, unless to persons engaged in the open air, in the most active and severe kinds of labour.

21
Different kinds of grain are not essentially different.

In other respects, however, it does not appear that there is much difference in point of quality or wholesomeness between the various kinds of grain cultivated in different countries. They are all capable of affording nourishment to the human constitution, and of preserving it in health and vigour: When grinded into meal, they require little farther preparation, and are easily made into bread, or otherwise prepared for immediate consumption, by being mixed according to the fancy or taste of different nations, with a small quantity of water, or any other liquid.

22
Roots used as human food.

Of the roots which are used to afford subsistence to man, the potato has hitherto been the principal. The rest, consisting chiefly of carrots, turnips, and parsnips, are never used as a sole nutriment, being rather adopted for the purpose of giving variety and relish to other food, and chiefly to butchers meat. The potato, however, is in some measure an exception to this general rule. It contains a large quantity of starch, which does not seem inferior to the starch prepared from wheat, so far at least as that ingredient is to be regarded as contributing to the nourishing qualities of the grain. Its taste resembles, more nearly than any other root, the taste of bread; and accordingly it is daily beginning to be more extensively used, and to form a larger portion of the food of the poor. The celebrated Dr Adam Smith long since remarked its tendency to produce a strong and handsome race of people, as demonstrated by its effect upon the common people of Ireland, who have for a considerable length of time in a great measure subsisted upon it.

It is to be observed concerning all the roots now mentioned, that a crop of them always contains a much larger quantity of human food than a crop of any kind of grain upon the same extent of ground. A Scots acre of good land, which will not produce more than 1280 pounds weight of oatmeal, will easily produce 20,000 pounds weight of potatoes, and will sometimes in favourable seasons produce 30,000 or 35,000 pounds weight of that valuable root.

Potatoes, however, and all the other roots, have hitherto possessed these radical defects: The carriage of them is extremely expensive, in consequence of their weight, arising from the vast quantity of moisture they contain. Hence they can only be cultivated in abundance in the vicinity of great towns, or where they are meant to be consumed upon the farm as the food of cattle.

Roots are also incapable of long preservation. In the winter they are destroyed by frost, and in summer by heat, which causes them to vegetate or to corrupt; both of which changes render them unfit to be used as food.

These roots are also much more bulky than grain in proportion to the quantity of nourishment contained in them. Hence they are rendered less fit to be consumed by persons engaged in sedentary professions. Such persons accordingly seldom fail to find them injurious to the stomach, by their bulkiness, and their tendency to injure the powers of digestion, by producing flatulencies and other unpleasant consequences.

On the whole, the difference between these succulent roots and the grain of corn plants seems to amount to this, that, although they are both formed of similar substances, the potato being analogous to wheat, and the carrot and parsnip to rye, or rather to barley after it has been converted into malt, yet, as the roots are formed in the bosom of the soil, and are of a loose and watery texture, their formation requires from nature a slighter effort than the bringing to perfection the small grains which are produced in the air at the top of corn plants. She therefore compensates by an abundant crop the diminished quality of her work.

Hence it has appeared an important problem in economics, to devise a plan by which the succulent roots may be of vegetables may be deprived of their superfluous moisture, that thus human art may perform for them what nature has not accomplished; and that they may be rendered completely equal in value to grain in point of quality, while in quantity they are so superior. With this view different processes have been adopted. Potatoes have been grated down in their raw state, and repeatedly washed with water: the result of which operation is, that the starch contained in them is obtained with great labour; but the rest of the root is lost; and this operation cannot be applied to other kinds of roots with success. Another mode of accomplishing the object was devised a few years ago by M. Grenet, and published in the Journal of the Lycæum of Arts of Paris. It is performed in this manner: The potatoes must first be boiled by the heat of the steam of boiling water, without touching the water itself. They are then stript of their skin, and allowed to cool, and made use of in the following way:—A white iron tube of two inches diameter, and eight inches in length, open at the one end and close at the other, is everywhere

where perforated with small holes, and a round piece of wood is prepared, which easily goes into the tube, but which at the same time fills it. Things being thus in readiness, a quantity of the potatoes, boiled as already mentioned, is put into the tube till it is full. They are then forcibly rammed down with the round piece of wood or piston; the consequence of which operation is, that they are forced through the little holes in the sides of the tube, and come out in the shape of worms. They are received upon linen cloths, covered with unsized paper, and dried in the heat of the sun, or in a warm room. The small pieces must be stirred from time to time; and it is said, that in less than 12 hours, the preparation dries so as to be capable of being preserved.

The defect of this process evidently is, that it is a petty operation, which can only proceed slowly, and upon a diminutive scale. It is therefore unlikely to be adopted in the great operations of an extensive agriculture, as a mode of preparing or preserving human food.

At the beginning of the present year 1802, another process for accomplishing this important object was contrived by Robert Forsyth, Esq. advocate. Of this process, which has been communicated to the Board of Agriculture, we are authorized to give the following account:

The whole difficulty of discovering a process, with the view to render succulent roots as easily preserved and transported, and therefore in every respect as valuable as grain, seems to arise from our not having the command of such a degree of steady and vigorous, but moderate heat, as will deprive them of their moisture, while at the same time they are prevented from being burnt or scorched in the way that coffee-beans are treated before being grinded. This requisite degree of heat may be obtained in a very cheap and easy manner, by making use of the steam of boiling water, which never can burn any vegetable substance. Upon this principle, Mr Forsyth's process is founded, and is conducted in the following manner:

1st, Let a quantity of potatoes, or carrots, or parsnips, &c. be washed, and then cut or chopped into very small pieces.

2dly, Lay them upon a metallic plate, and dry them with the heat of steam transmitted through the metal. They are then in a state analogous to grain, and seem capable of being preserved for any length of time.

3dly, Reduce them into flour or meal, by grinding in any mill, or with any instrument capable of grinding grain.

The meal or flour thus prepared has no tendency to attract moisture from the atmosphere, and may be preserved during any length of time, if closely pressed or packed. Without this precaution, Mr Forsyth has preserved it for six months, when it had been coarsely grinded in a coffee mill.

The drying process is not tedious. As potatoes contain a great quantity of starch or gummy matter, the pieces of them, while drying, are apt to adhere to each other; they must therefore be frequently turned or stirred during that part of the operation. When dry, they are almost as hard as barley, and taste somewhat like the skin of a roasted potato.

Carrots and parsnips contain less gummy matter.

They require less attention while drying, and do not become so hard. They may be grinded with ease. Their flour is very sweet to the taste. Its smell is fragrant, and though the taste of the roots cannot be said to be altered, it is rendered rich and agreeable by the concentration produced by the process. This is more particularly the case with regard to the parsnips. Their meal, when coarsely grinded, and exposed to the air for a month or two, loses its grateful smell, but the taste continues unchanged. The taste is communicated very rapidly to lukewarm water, by pouring it upon the meal, so that it may probably prove of some value when subjected to the vinous fermentation; and it seems not improbable, that if sugar is ever to be produced in abundance from plants of European growth, it must be by preparing them according to this process.

Mr Forsyth performed his experiments with a steam apparatus, which, with some alterations, may prove not unsuitable, when erected upon a great scale.

A, Plate XII, A shallow vessel of white iron, one foot square, and two inches in depth, for containing substances to be dried.

B, a small round vessel, in which water is kept boiling by a lamp, C, with three wicks.

D, a tube, by which the steam passes into E, which contains the drying vessel A, and is closely soldered all round to the bottom of it.

F, a tube, by which the water formed by the condensed steam flows from the steam vessel, E, back into the boiler B, entering at the bottom of the boiler.

G, a crooked tube, by which the superfluous steam escapes into the open air. It is crooked, that it may retard the passage of the steam when the vessel is at work, which forces it to deposit more of its heat on the bottom of the drying vessel A.

H, a tube by which the boiler B is filled with hot water.

I, a tube passing up through the centre of the boiler, and serving as a chimney to the lamp C. It does not communicate with the water in the boiler.

K shows the figure of the cover of the drying vessel A. The cover has a groove or gutter LL, passing round its lower edge. The vapour which rises from the roots when drying, condenses on touching the cover, and flows down to the gutter, from which it escapes in the state of water, by a hole left for that purpose at each corner. The cover is only used for the neatness requisite in making experiments.

The whole is supported by four moveable feet, attached to the corners of the drying vessel A, but not appearing in the figure. Every part of it is made of white iron or tinned plate.

Instead of the lamp C, a small iron pan filled with pieces of burning charcoal, was sometimes used to keep the water boiling, and a still more convenient plan was at times adopted during the winter season. It consisted of resting the bottom of the boiler B, upon the front of the grate of the chamber, while a fire was burning, the rest of the instrument being at the same time supported by a rope attached to the back of a chair, to a nail or peg in the wall for hanging a picture, or to any other convenient support. When used in this last manner, however, the instrument has this defect,

Vegetables
Food for
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Vegetables
Food for
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is into
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33
Mr For-
syth's steam
apparatus.

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Cattle.

defect, that the water in the tube H boils over at times into the fire, which might be avoided, by placing the tube on the opposite side of the boiler.

Upon the above contrivance, it may be remarked that a kiln formed of a large metallic plate, heated by the steam of boiling water, may prove valuable in many processes. In particular, it will probably be found useful for drying malt, with a view to prevent the ale formed of it from having a brown colour. It may also, perhaps, be used with success for drying wheat that is intended to be sown, to prevent the future crop from suffering by mildew, as will be afterwards mentioned; and it affords a ready and cheap mode of drying not only roots, but all vegetable productions, without burning them, or altering their taste or other essential properties.

SECT. II. *Of the most proper kinds of Vegetables to be raised for the purposes of feeding Cattle.*

THOUGH this must be an article of the utmost consequence to every farmer, we do not find that it has been much considered. Mr Anderson seems to have been the first writer on agriculture who hath properly attended to this subject; and what he hath wrote upon it, is rather a catalogue of desiderata than any thing else: and indeed the desiderata on this subject are so many and so great, that we must acknowledge ourselves very unable to fill them up.—To attain to a competent knowledge in this respect, the following things must be taken into consideration. (1.) The wholesomeness of the food for cattle, with regard to health and strength, or fatness. (2.) The quantity that any extent of ground is capable of yielding. (3.) The quantity necessary to feed the different kinds of cattle. (4.) The labour of cultivation; and, (5.) The soil they require to bring them to perfection, and the effect they have upon it.

With regard to the wholesomeness, it is plain, that as the natural food of wild cattle is the green succulent plants they meet with all the year round, food of this kind, could it be had, must be preferable to hay; and accordingly we find that cattle will always prefer succulent vegetables where they can get them. To find plants of this kind, and having proper qualities in other respects, we must search among those which continue green all the year round, or come to their greatest perfection in the winter time.—Of these, cabbages bid fair for holding the first place; both as being very succulent, and a very large quantity of them growing upon a small space of ground. In Mr Young's Six Months Tour, we have an account of the produce of cabbages in many different places, and on a variety of soils. The produce by Mr Crow at Keplin, on a clay soil, was, on an average of six years, 35 tons per acre; by Mr Smelt at the Leases, on a sandy gravel, 18 tons per acre; by Mr Scroop at Danby, on an average of six years, 37 tons per acre: and the general average of all the accounts given by Mr Young, is 36 tons per acre.

Cabbages, however, have the great inconveniency of sometimes imparting a disagreeable flavour to the milk of cows fed with them, and even to the flesh of other cattle. This, it is said, may be prevented by carefully picking off the decayed and withered leaves:

and very probably this is the case: for no vegetable inclines more to putrefaction than this; and therefore particular care ought to be taken to pull off all the leaves that have any symptoms of decay. Dr Priestley found that air was rendered noxious by a cabbage leaf remaining in it for one night, though the leaf did not show any symptom of putrefaction.—For milk cows, probably, the cabbages might be rendered more proper food by boiling them.

The culture of the/turnip-rooted cabbage has lately been much practised, and greatly recommended, particularly for the purpose of a late spring feed; and seems indeed to be a most important article in the farming economy, as will be shown in its proper place.

Turnips likewise produce very bulky crops; the average weight of an English acre being from 20 to 25 tons, and that of a very full crop as high as 30 tons and upwards.

Carrots are found to be an excellent food for cattle of all kinds, and are greatly relished by them. In a rich sand, according to Mr Young's account, the produce of this root was 200 bushels per acre. In a finer soil, it was 640 bushels per acre. It is probable, indeed, that carrots will make a more wholesome food for cattle than either cabbages or turnips, as they are strongly antiseptic; insomuch as to be used in poultices for correcting the sanies of cancers. It is probably owing to this, that the milk of cows fed on carrots is never found to have any bad taste. Six horses kept on them through the winter without oats, performed their work as usual, and looked equally well. This may be looked upon as a proof of their salubrity as a food; and it certainly can be no detriment to a farmer, to be so much versant in medical matters as to know the impropriety of giving putrescent food to his cattle. It is well known what a prodigious difference there is in the health of the human species when fed on putrid meats, in comparison of what they enjoy when supplied with food of a contrary nature; and why may there not be a difference in the health of beasts, as well as of men, when in similar circumstances?—It is also very probable, that as carrots are more solid than cabbages or turnips, they go much farther in feeding cattle than either of them.

Potatoes likewise appear to be a very palatable food for all kinds of cattle; and not only oxen, hogs, &c. are easily fed by them, but even poultry. According to a correspondent of the Bath Society*, "roasting pork is never so moist and delicate as when fed with potatoes, and killed from the barn doors without any confinement." For bacon and hams, two bushels of pea-meal should be well incorporated with four bushels of boiled potatoes, which quantity will fat a hog of twelve stone, (fourteen pounds to the stone).

Buck-wheat (*Polygonum fagopyrum*) has been lately recommended as an useful article in the present as well as other respects. It has been chiefly applied to the feeding of hogs, and esteemed equal in value to barley; it is much more easily ground than barley, as a malt-mill will grind it completely. Horses are very fond of the grain; poultry of all sorts are speedily fattened by it; and the blossom of the plant affords food for bees at a very opportune season of the year, when the meadows and trees are mostly stripped of their flowers. Probably the grain may hereafter be even found a material article

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Qualities of
the food
requisite for
cattle.

33
Cabbages,
their pro-
perties.

Food for
Cattle.

36
Air rendered
noxious
by them.

37
Turnip-
rooted
cabbage.

38
Turnips.

39
Carrots.

40
Potatoes.

41
Lettuce
and Pap-
on Agric-
ture, &c.
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Buck-
wheat.

in distillation, should a sufficient quantity be raised with that view. From the success of some experiments detailed in the Bath Society Papers, and for which a premium was bestowed, it has been inferred that this article ought in numerous cases to supersede the practice of summer-fallowing.

Whins have lately been recommended as a very proper food for cattle, especially horses; and are recommended by Mr Anderson in a particular manner. They have this advantage, that they require no culture, and grow on the very worst soil; but they are troublesome to cut, and require to be bruised in a mill constructed for the purpose; neither is the ground at all meliorated by letting whins grow upon it for any length of time. Notwithstanding these disadvantages, however, as whins continue green all the year round, and when bruised will afford an excellent succulent food, which seems possessed of strongly invigorating qualities, they may be looked upon as the cheapest winter food that can possibly be given to cattle.—According to the calculations of Mr Eddison of Gateford, a single acre, well cropped with whins, will winter six horses: at three or four years growth, the whole crop should be taken, cut close to the ground, and carried to the mill; in which the whins are to be bruised, and then given to the horses. Four acres ought to be planted, that one may be used each year, at the proper age to be cut; and he reckons the labour of one man sufficient for providing food to this number of horses. He says, they all prefer the whins to hay, or even to corn.

The herb called *burnet* hath likewise been recommended as proper food for cattle, on account of its being an evergreen; and further recommended, by growing almost as fast in winter as in summer. Of this herb, however, we have very various accounts. In a letter addressed by Sir James Caldwell, F. R. S. to the Dublin Society, the culture of this plant is strongly recommended, on the authority of one Bartholomew Rocque, farmer at Walham-Green, a village about three miles south-west of London.

What gave occasion to the recommendation of this plant, was, that about the year 1760, Mr Wych, chairman of the committee of Agriculture of the London Society for the encouragement of arts, manufactures, and commerce, came to Rocque (who was become very eminent by the premiums he had received from the society), and told him, he had been thinking, that as there are many animals which subsist wholly upon the fruits of the earth, there must certainly be some plant or herb fit for them that naturally vegetates in winter; otherwise we must believe the Creator, infinitely wise and good, to have made creatures without providing for their subsistence; and that if there had been no such plants or herbs, many species of animals would have perished before we took them out of the hands of nature, and provided for them dry meat at a season, when, indigenous plants having been indiscriminately excluded, under the name of weeds, from cultivated fields and places set apart for natural grass, green or fresh meat was no longer to be found.

Rocque allowed the force of this reasoning; but said, the knowledge of a grass, or artificial pasture, that would vegetate in winter, and produce green fodder for cattle, was lost; at least, that he knew of no such plant.—Mr Wych, however, knowing how very great

that advantage would be of discovering a green fodder for winter and early in the spring, wrote to Bern, and also to some considerable places in Sweden, stating the same argument, and asking the same question. His answers to these letters were the same that had been given by Rocque. They owned there must be such plant, but declared they did not know it.

Mr Wych then applied again to Rocque; and desired him to search for the plant so much desired, and so certainly existing. Rocque set about this search with great assiduity; and finding that a pimpernel, called *burnet*, was of very speedy growth, and grew nearly as fast in winter as in summer, he took a handful of it and carried it into his stable, where there were five horses; every one of which ate of it with the greatest eagerness, snatching it even without first smelling it. Upon the success of this experiment he went to London, and bought all the burnet seed he could get, amounting to no more than eight pounds, it having been only used in salads; and he paid for it at the rate of 4s. a pound. Six of the eight pounds of seed he sowed upon half an acre of ground, in March, in the year 1761, with a quarter of a peck of spring wheat, both by hand. The seed being very bad, it came up but thin. However, he sowed the other two pounds in the beginning of June, upon about six rood of ground: this he mowed in the beginning of August; and at Michaelmas he planted off the plants on about 20 rood of ground, giving each plant a foot every way, and taking care not to bury the heart. These plants bore two crops of seed the year following; the first about the middle of June, the second about the middle of September; but the June crop was the best. The year after it grew very rank, and produced two crops of seed, both very good. As it ought not to be cut after September, he let it stand till the next year; when it sheltered itself, and grew very well during all the winter, except when there was a hard frost; and even during the frost it continued green, though it was not perceived to grow. In the March following it covered the ground very well, and was fit to receive cattle.

If the winter is not remarkably severe, the burnet, though cut in September, will be 18 inches long in March; and it may be fed from the beginning of February till May: if the cattle are taken off in May, there will be a good crop of seed in the beginning of July. Five weeks after the cattle are taken off, it may be removed, if that is preferred to its standing for seed. It grows at the rate of an inch a-day, and is made into hay like other grass. It may be mown three times in one summer, and should be cut just before it begins to flower. Six rood of ground has produced 1150 pounds at the first cutting of the third year after it was sowed; and, in autumn 1763, Rocque sold no less than 300 bushels of the seed.

According to Rocque, the soil in which burnet flourishes best, is a dry gravel; the longest drought never hurts it: and Sir James Caldwell asserts, that he saw a very vigorous and exuberant plant of this kind, growing from between two bricks in a wall in Rocque's ground, without any communication with the soil; for he had cut away all the fibres of the root that had stretched downward, and penetrated the earth long before.

Burnet was found equally fit for feeding cows, sheep, and

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and horses; but the sheep must not be suffered to crop it too close. Though no seed was left among the hay, yet it proved nourishing food; and Rocque kept a horse upon nothing else, who, at the time of writing the account, was in good heart, and looked well. He affirmed also, that it cured horses of the distemper called the *grease*, and that by its means he cured one which was thought incurable; but says, it is only the first crop which has this effect.

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Burnet recom-
mended an
improper
food by Mr
Miller and
Mr Ander-
son.

This is the substance of Sir James Caldwell's letter to the Dublin Society, at least as to what regards the culture of burnet; and it might reasonably be expected, that a plant, whose use was recommended to the public with so much parade, would soon have come into universal esteem. We were surprised, therefore, on looking into Mr Miller's Dictionary, to find the following words, under the article *Poterium*:—"This plant has of late been recommended by persons of little skill, to be sown as a winter pabulum for cattle: but whoever will give themselves the trouble to examine the grounds where it naturally grows, will find the plants left uneaten by the cattle, when the grass about them has been cropped to the roots; besides, in wet winters, and in strong land, the plants are of short duration, and therefore very unfit for that purpose; nor is the produce sufficient to tempt any person of skill to engage in its culture; therefore I wish those persons to make trial of it in small quantities, before they embark largely in these new schemes."—Mr Anderson, too, in his *Essays on Agriculture*, mentions the produce of burnet being so small, as not to be worth cultivating.

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White beet
recom-
mended.

Upon the authority of Mr Rocque, likewise, the white beet is recommended as a most excellent food for cows; that it vegetates during the whole winter, consequently is very forward in the spring; and that the most profitable way of feeding cows is to mow this herb, and give it to them green all the summer. It grew in Rocque's garden, during a very great drought, no less than four feet high, from the 30th of May to the 3d of July; which is no more than one month and four days. In summer it grows more than an inch a day; and is best sown in March: a bushel is enough for an acre, and will not cost more than ten shillings. It thrives best in a rich, deep, light soil: the stalks are very thick and succulent; the cows should therefore eat them green.

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Root of
scarcity.

Another species of beet (*Beta cicla*), the Mangel Wurzel, or *Root of Scarcity*, as it has been called, has been lately extolled as food both for man and cattle; but, after all, seems only to deserve attention in the latter view. It is a biennial plant; the root is large and fleshy, sometimes a foot in diameter. It rises above the ground several inches, is thickest at the top, tapering gradually downward. The roots are of various colours, white, yellow, and red; but these last are always of a much paler colour than beetrave. It is good fodder for cows, and does not communicate any taste to the milk. It produces great abundance of leaves in summer, which may be cut three or four times without injuring the plant. The leaves are more palatable to cattle than most other garden plants, and are found to be very wholesome. The farmers in those parts of Germany where it is chiefly cultivated, we are told, prefer this species of beet, for feeding cattle, to cab-

bage, principally because they are not so liable to be hurt by worms or insects; but they think they are not so nourishing as turnips, potatoes, or carrots, and that cattle are not nearly so soon fattened by this root as by carrots, parsnips, or cabbages. It has even been asserted that this root affords less nourishment than any of those that have been commonly employed for feeding cattle. This does not correspond with the pompous accounts with which the public has been entertained. Upon the whole, however, it is a plant that seems to deserve the attention of our farmers; as on some soils, and in particular circumstances, it may prove a very useful article for the above purposes.

In Mr Anderson's *Essays*, we find it recommended to make trial of some kinds of grasses, which probably would not only answer for fresh fodder during the winter, but might also be cut for hay in summer. This is particularly the case with that species called *sheep's fescue grass*. "I had, says he, a small patch of this grass in winter 1773; which, having been cut in the month of August or September preceding, was saved from that period, and had advanced before winter to the length of five or six inches; forming the closest pile that could be imagined. And although we had about six weeks of very intense frost, with snow, and about other six weeks, immediately succeeding that, of exceeding keen frost every night, with frequent thaws in the day time, without any snow, during which time almost every green thing was destroyed; yet this little patch continued all along to retain as fine a verdure as any meadow in the month of May; hardly a point of a leaf having been withered by the uncommon severity of the weather. And as this grass begins to vegetate very early in the spring, I leave the reader to judge what might be the value of a field of grass of this kind in these circumstances."

Of another kind of grass, called *purple fescue*, Mr Anderson gives the following character: "It retained its verdure much better than rye-grass during the winter season; but it had more of its points killed by the weather than the former. It likewise rises in the spring, at least as early as rye-grass."

This ingenious farmer has also made experiments on the culture of these and several other kinds of grasses; which being very well worthy of attention, we shall here insert.

1. *Purple fescue grass*. "Although this grass is very often found in old pastures, yet, as it has but few flower-stalks, and as it is greedily eaten by all domestic animals, these are seldom suffered to appear; so that it usually remains there unperceived. But it seems to be better able to endure the peculiar acrimony of the dung of dogs than almost any other plant; and is therefore often to be met with in *dog hills*, as I call the little hills by roadsides where dogs usually piss and dung: and as it is allowed to grow there undisturbed, the farmer may have an opportunity of examining the plant, and becoming acquainted with its appearance.

"The leaves are long and small, and appear to be roundish, something like a wire; but, upon examination, they are found not to be tubulated like a reed or rush; the sides of the leaf being only folded together from the middle rib, exactly like the strong bent-grass on the sea shore. The flower-stalk is small, and branches out in the head, a little resembling the wild

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Sheep's fescue grass.

49
Purple fescue.

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Cattle.

wild oat; only the grains are much smaller, and the ear does not spread full open, but lies bending a little to one side. The stalks are often spotted with reddish freckles, and the tops of the roots are usually tinged with the same colour; from whence it has probably obtained its distinctive name of *festuca rubra*, or red (purple) fescue.

"It is often to be met with in old garden walks; and, as its leaves advance very quickly after cutting, it may usually be discovered above the other grasses, about a week or fortnight after the walks are cut. Nor do they seem to advance only at one season, and then stop and decay, like the rye-grass; but continue to advance during the whole of the summer, even where they are not cut; so that they sometimes attain a very great length. Last season (1774), I measured a leaf of this grass, that sprung up in a neglected corner, which was four feet and four inches in length, although not thicker than a small wire. It is unnecessary to add, that these leaves naturally trail upon the ground, unless where they meet with some accidental support; and that if any quantity of it is suffered to grow for a whole season, without being eaten down or cut, the roots of the leaves are almost rotted, by the overshadowing of the tops of the other leaves, before the end of the season.

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appear-
ance in its
cultivated
state.

"This is the appearance and condition of the plant in its native situation: as it is seldom that it is discovered but in pretty old pastures, and as in that state it carries only a very few seed-stalks, it was with some difficulty that I could collect a small handful of the seed, which I carefully sowed in a small patch of garden mould, to try if it could be easily cultivated. It came up as quickly as any other kind of grass, but was at first as small as hairs: the leaves, however, advanced apace; and were, before autumn, when the grain with which they had been sowed was cut down, about 16 or 18 inches in length; but having been sown very thin, it was necessary to pick out some other kinds of grass that came up amongst it, lest it might have been choked by them. Early next spring it advanced with prodigious vigour, and the tufts that were formed from every seed became exceeding large; so that it quickly filled the whole ground. But now the leaves were almost as broad as those of common rye-grass, and the two sides only inclined a little towards one another from the mid-rib, without any appearance of roundness. In due time a great many seed-stalks sprung out, which attained very nearly to the height of four feet, and produced seeds in abundance; which may be as easily saved as those of common rye-grass.

"The prodigious difference between this plant in its native and cultivated state amazed me; but it was with a good deal of satisfaction that I found there would be no difficulty in procuring seeds from it, which I had much doubted of at first. It would seem, that nature hath endowed this plant with a strong generative power during its youth, which it gradually loses as it advances in age (for the difference perceived in this case could not be attributed to the richness of the soil); and that, on the contrary, when it was old, the leaves advanced with an additional vigour, in proportion to the declining strength of the flower stalks: for the leaves of the young plants seldom exceed two feet,

whereas numbers of the old leaves were near four feet in length.

"From these peculiarities in the growth of this plant, it would seem to promise to be of great use to the farmer; as he could reap from a field of it, for the first two or three years, as great a weight of hay as he could obtain from any of the culmiferous grasses (those bearing a long jointed stalk; and, if he meant afterwards to pasture it, he would suffer no inconveniences from the flower-stalks; and the succulent leaves that continue to vegetate during the whole summer, would at all times furnish his cattle with abundance of wholesome food. It has also been remarked, that this grass rises as early in the spring as rye-grass; and continues green for the greatest part of winter, which the other does not. It is moreover an abiding plant, as it seems never to wear out of the ground where it has once been established. On all which accounts, it appears to me highly to merit the attention of the farmer; and well deserves to have its several qualities, and the culture that best agrees with it, ascertained by accurate experiments.

2. "*Sheep's fescue grass*, or *festuca ovina*, is much praised by the Swedish naturalists for its singular value as a pasture-grass for sheep; this animal being represented as fonder of it than of any other grass, and fattening upon it more quickly than on any other kind of food whatever. And indeed, the general appearance of the plant, and its peculiar manner of growth, seems very much to favour the accounts that have been given us of it.

51
Sheep's fescue
described.

"This plant is of the same family with the former, and agrees with it in several respects; although they may be easily distinguished from one another. Its leaves, like the former, in its natural state, are always rounded, but much smaller; being little bigger than large horse hairs, or swine-bristles, and seldom exceed six or seven inches in length. But these spring out of the root in tufts, so close upon one another, that they resemble, in this respect, a close hair brush more than any thing else I know: so that it would seem naturally adapted to form that short thick pile of grass in which sheep are known chiefly to delight. Its flower-stalks are numerous, and sometimes attain the height of two feet; but are more usually about 12 or 15 inches high.

"Upon gathering the seeds of this plant, and sowing them as the former, it was found that they sprang up as quickly as any other kind of grass; but the leaves are at first no bigger than a human hair. From each side springs up one or two of these hair-like filaments, that in a short time send out new offsets, so as quickly to form a sort of tuft, which grows larger and larger, till it at length attains a very large size, or till all the intervals are closed up, and then it forms the closest pile of grass that it is possible to imagine. In April and May it pushed forth an innumerable quantity of flower-stalks, that afforded an immense quantity of hay; it being so close throughout, that the scythe could scarcely penetrate it. This was allowed to stand till the seeds ripened; but the bottoms of the stalks were quite blanched, and almost rotted for want of air before that time.

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Its appearance
when cultivated.

"This was the appearance that it made the first year after

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after it was sowed: but I have reason to think, that, after a few years, it likewise produces fewer seed-stalks, and a greater quantity of leaves, than at first. But however that may be, it is certain, that if these are eaten down in the spring, it does not, like rye-grass, persist in a continued tendency to run to seed; but is at once determined to push forth a quantity of leaves without almost any stalks at all: and as all domestic animals, but more especially sheep, are extremely fond of this grass, if they have liberty to pasture where it grows, they bite it so close as never to suffer almost a single seed-stalk to escape them; so that the botanist will often search in vain for it, when he is treading upon it with his feet. The best way to discover it in any pasture, is to search for it in winter, when the tufts of it may be easily distinguished from every other kind of grass, by their extraordinary closeness, and the deep green colour of the leaves.

53
What soil
most pro-
per.

"It seems to grow in almost any soil; although it is imagined that it would flourish best in a light sandy soil, as it can evidently live with less moisture than almost any other kind of grass; being often seen to remain in the sods that have been employed in coping for stone dykes, after all the other grasses that grew in them have disappeared. It is likewise found in poor barren soils, where hardly any other plant can be made to grow at all: and on the surface of dry worn-out peat moss, where no moisture remains sufficient to support any other plant whatever: but in neither of these situations does it thrive; as it is there only a weak and unsightly plant, very unlike what it is when it has the good fortune to be established upon a good soil; although it is seldom met with in this last state than in the former.

"I will not here repeat what has been already said about the particular property that this plant possesses of continuing all winter; nor point out the benefits that the farmer may reap from this valuable quality.—He need not, however, expect to find any verdure in winter on such plants as grow upon the loose mossy soil above mentioned; for, as the frost in winter always hoves up the surface of this soil, the roots of the plants are so lacerated thereby, as to make it, for some time in the spring, to all appearance dead. Nor will he often perceive much verdure in winter upon those plants that grow upon poor hungry soils, which cannot afford abundant nourishment to keep them in a proper state of vegetation at all times: but such plants as grow on earthen dykes, which usually begin to vegetate with vigour when the autumnal rains come on, for the most part retain their verdure at that season almost as well as if they were in good garden-mould.

"I have been very particular in regard to this plant; because, in as far as my observations have yet gone, it promises on many accounts to make a most valuable acquisition to the farmer, and therefore justly demands a very particular share of his attention."

54
Holeus la-
natus.

3. The *holcus lanatus*, or creeping soft-grass of Hudson.—This is considered by our author as one of the most valuable kinds of meadow-grasses; its pile being exceedingly close, soft, and succulent. It delights much in moisture, and is seldom found on dry ground, unless the soil is exceeding rich. It is often found on those patches near springs, over which the water frequently flows; and may be known by the uncommon softness and succulence of the blade, the lively light

green colour of the leaves, and the matted intertexture of its roots. But, notwithstanding the softness of its first leaves, when the seed-stalks advance, they are rough to the touch, so that the plant then assumes a very different appearance from what we would have expected. The ear is branched out into a great number of fine ramifications somewhat like the oat, but much smaller.—This kind of grass, however, would not be easily cultivated, on account of a kind of soft membrane that makes the seeds adhere to the stalk, and to one another after they are separated from it, as if they were intermixed with cobweb, so that it is difficult to get them separated from the stalk, or to spread readily in sowing. It spreads, however, so fast by its running roots, that a small quantity sowed very thin, would be sufficient to stock a large field in a short time.

These are the kinds of *grasses*, properly so called, which have not as yet been cultivated, that Mr Anderson thinks the most likely to be of value; but, besides these, he recommends the following of the pea-tribe.

1. *Milk-vetch*, *liquorice-vetch*, or *milkwort*. This plant, in some respects, very much resembles the common white clover: from the top of the root a great number of shoots come out in the spring, spreading along the surface of the ground every way around it; from which arise a great many clusters of bright yellow flowers, exactly resembling those of the common broom. These are succeeded by hard round pods, filled with small kidney-shaped seeds. From a supposed resemblance of a cluster of those pods to the fingers of an open hand, the plant has been sometimes called *ladies-fingers*. By others it is called *crow-toes*, from a fancied resemblance of the pods to the toes of a bird. Others, from the appearance of the blossom, and the part where the plant is found, have called it *feal*, improperly *fell-broom*. It is found plentifully almost everywhere in old grass fields; but as every species of domestic animals eat it, almost in preference to any other plant, it is seldom allowed to come to the flower in pasture grounds, unless where they have been accidentally saved from the cattle for some time; so that it is only about the borders of corn fields, or the sides of inclosures to which cattle have not access, that we have an opportunity of observing it. As it has been imagined that the cows which feed on the pastures, where this plant abounds, yield a quantity of rich milk, the plant has, from that circumstance, obtained its most proper English name of *milk-vetch*.

One of the greatest recommendations of this plant is, that it grows in poor barren ground, where almost no other plant can live. It has been observed in ground so poor, that even heath, or ling (*erica communis*), would scarcely grow; and upon bare obdurate clays, where no other plant could be made to vegetate; inasmuch that the surface remained entirely uncovered, unless where a plant of this kind chanced to be established: yet, even in these unfavourable circumstances, it flourished with an uncommon degree of luxuriance, and yielded as tender and succulent, though not such abundant shoots, as if reared in the richest manured fields. In dry barren sands, also, where almost no other plant could be made to live, it has been found to send out such a number of healthy shoots all round, as to cover the earth with the closest and most beautiful carpet that can be desired.

The

Food for Cattle. The stalks of the milk-vetch are weak and slender, so that they spread upon the surface of the ground, unless they are supported by some other vegetable. In ordinary soils they do not grow to a great length, nor produce many flowers; but in richer fields the stalks grow to a much greater length, branch out a good deal, but carry few or no flowers or seeds. From these qualities our author did not attempt at first to cultivate it with any other view than that of pasture; and, with this intention, sowed it with his ordinary hay seeds, expecting no material benefit from it till he desisted from cutting his field. In this, however, he was agreeably disappointed; the milk-vetch growing the first season as tall as his great clover, and forming exceeding fine hay; being scarce distinguishable from lucerne, but by the slenderness of the stalk, and proportional smallness of the leaf.

Another recommendation to this plant is, that it is perennial. It is several years after it is sowed before it attains to its full perfection; but when once established, it probably remains for a great number of years in full vigour, and produces annually a great quantity of fodder. In autumn 1773, Mr Anderson cut the stalk from an old plant that grew on a very indifferent soil; and, after having thoroughly dried it, he found that it weighed 14 ounces and a half.

The stalks of this plant die down entirely in winter, and do not come up in the spring till the same time that clover begins to advance; nor does it advance very fast, even in summer, when once cut down or eaten over: so that it seems much inferior to the above-mentioned grasses; but it might be of use to cover the worst parts of a farm, on which no other vegetable could thrive.

2. The common yellow vetchling (*Lathyrus pratensis*), or everlasting tare, grows with great luxuriance in stiff clay soils, and continues to yield annually a great weight of fodder, of the very best quality, for any length of time. This is equally fit for pasture or hay; and grows with equal vigour in the end of summer as in the beginning of it; so would admit being pastured upon in the spring, till the middle, or even the end of May, without endangering the loss of the crop of hay. This is an advantage which no other plant except clover possesses; but clover is equally unfit for early pasture or for hay. Sainfoin is the only plant whose qualities approach to it in this respect, and the yellow vetchling will grow in such soils as are utterly unfit for producing sainfoin.—It is also a perennial plant, and increases so fast by its running roots, that a small quantity of the seed would produce a sufficient number of plants to fill a whole field in a very short time. If a small patch of good ground is sowed with the seeds of this plant in rows, about a foot distance from one another, and the intervals kept clear of weeds for that season, the roots will spread so much as to fill up the whole patch next year; when the stalks may be cut for green fodder or hay. And if that patch were dug over in the spring following, and the roots taken out; it would furnish a great quantity of plants, which might be planted at two or three feet distance from one another, where they would probably overspread the whole field in a short time.

3. The common blue tare seems more likely than the former to produce a more flourishing kind of hay, as

it abounds much more in seeds; but as the stalks come up more thinly from the root, and branch more above, it does not appear to be so well adapted for a pasture grass as the other. The leaves of this plant are much smaller, and more divided, than those of the other; the stalks are likewise smaller, and grow to a much greater length. Though it produces a great quantity of seeds, yet the small birds are so fond of them, that, unless the field were carefully guarded, few of them would be allowed to ripen.

4. The *vicia sepium*, purple everlasting, or bush-vetch. ⁵⁹ Our author gives the preference to this plant beyond all others of the same tribe for pasture. The roots of it spread on every side a little below the surface of the ground, from which, in the spring, many stems arise quite close by one another; and as they have a broad tufted top covered with many leaves, it forms as close a pile as could be desired. It grows very quickly after being cut or cropt, but does not arrive at any great height; so that it seems more proper for pasturage than making hay; although, upon a good soil, it will grow sufficiently high for that purpose; but the stalks grow so close upon one another, that there is great danger of having it rotted at the root, if the season should prove damp. It seems to thrive best in a clayey soil.

Besides these, there are a variety of others of the same class, which he thinks might be useful to the farmer. ⁶⁰ The common garden everlasting pea, cultivated as a flowering plant, he conjectures, would yield a prodigious weight of hay upon an acre; as it grows to the height of ten or twelve feet, having very strong stalks, that could support themselves without rotting till they attained a great height.

One other plant, hitherto unnoticed, is recommended by our author to the attention of the farmer; it is the common yarrow (*Achillea millefolium*), or hundred-leaved grass. ⁶¹ Concerning this plant, he remarks, that in almost every fine old pasture, a great proportion of the growing vegetables with which the field is covered consists of it; but the animals which feed there are so fond of the yarrow, as never to allow one seed-stalk of it to come to perfection. Hence these seed-stalks are never found but in neglected corners, or by the sides of roads; and are so disagreeable to cattle, that they are never tasted; and thus it has been erroneously thought that the whole plant was refused by them.—The leaves of this plant have a great tendency to grow very thick upon one another, and are therefore peculiarly adapted for pasturage. It arrives at its greatest perfection in rich fields that are naturally fit for producing a large and succulent crop of grass. It grows also upon clays; and is among the first plants that strike root in any barren clay that has been lately dug from any considerable depth; so that this plant, and thistles, are usually the first that appear on the banks of deep ditches formed in a clayey soil. All animals delight to eat it; but, from the dry aromatic taste it possesses, it would seem peculiarly favourable to the constitution of sheep. It seems altogether unfit for hay.

Besides these plants, which are natives of our own country, there are others which, though natives of a foreign climate, are found to thrive very well in Britain; and have been raised with such success by individuals, as highly to merit the attention of every farmer. Among these the first place is claimed by lucerne. ⁶²

This

Food for
Cattle.

This is the plant called *medica* by the ancients, because it came originally from Media, and on the culture of which they bestowed such great care and pains. It hath a perennial root, and annual stalks, which, in a good soil, rise to three feet, or sometimes more, in height; its leaves grow at a joint like those of clover; the flowers, which appear in June, are purple; and its pods are of a screw-like shape, containing seeds which ripen in September. All sorts of domestic cattle are fond of this plant, especially when allowed to eat it green, and black cattle may be fed very well with the hay made from it; but an excess of this food is said to be very dangerous.

Lucerne has the property of growing very quickly after it is cut down, insomuch that Mr Rocque has mowed it five times in a season, and Mr Anderson affirms he has cut it no less than six times. It is, however, not very easily cultivated; in consequence of which it sometimes does not succeed.

63
Timothy
grass.

Another grass was brought from Virginia, where it is a native, and sown by Rocque in 1763. This grass is called *timothy*, from its being brought from New-York to Carolina by one Timothy Hanson. It grows best in a wet soil; but will thrive in almost any. If it is sown in August, it will be fit for cutting in the latter end of May or beginning of June. Horses are very fond of it, and will leave lucerne to eat it. It is also preferred by black cattle and sheep; for a square piece of land having been divided into four equal parts, and one part sowed with lucerne, another with sainfoin, a third with clover, and the fourth with timothy, some horses, black cattle, and sheep, were turned into it, when the plants were all in a condition for pasturage; and the timothy was eaten quite bare, before the clover, lucerne, or sainfoin, was touched.

One valuable property of this grass is, that its roots are so strong and interwoven with one another, that they render the wettest and softest land, on which a horse could not find footing, firm enough to bear the heaviest cart. With the view of improving boggy lands, therefore, so as to prevent their being poached with the feet of cattle, Mr Anderson recommends the cultivation of this kind of grass, from which he has little expectation in other respects.

64
Grazing
compared
with the
plough.

On this subject, of the kind of plants most proper to be raised for feeding cattle, one general question ought not to pass unnoticed concerning the propriety of feeding them upon roots and plants cultivated by the aid of the plough, or upon leaving them to derive their subsistence from lands allowed to remain continually in pasturage. The advantages of the latter practice are set forth by Thomas Davis, Esq. of Longleet, in the following words. "Experience sufficiently evinces the extreme difficulty of persuading tenants that they get more (generally speaking) by feeding their lands, than by ploughing them; yet it requires very few arguments to convince a landlord, that, in cold wet land especially, the less ploughed land you have, the less you put it in the tenant's power to ruin your estate. That a tenant of 60l. per annum on a dairy farm will get money, while a corn farm of the same size will starve its occupier (though perhaps the former gives 15s. per acre for his land, and the latter only 10s.), is self-evident. The plough is a friend of every body's, though its advantages are very far from being particularly and local-

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pers, vol iii.

ly felt; corn being an article that will bear keeping till the whim or caprice, or supposed advantage of its possessor, call it forth. But the produce of the cow is far otherwise. Cheese must necessarily be sold at a certain period: it is a ponderous article; and one-twelfth, or at least one-fifteenth of its value, is often paid for carrying it to a fair 50 miles off; and the butter and skimmed milk find their way no great distance from home, as is evident by the price of butter varying frequently one-third in 20 or 30 miles. Every inhabitant of Bath must be sensible, that butter and cheese have risen one-third or more in price within 20 years. Is not this owing to the great encouragement given to the plough and to grazing, at a time when, on account of the increased demand for milk, cream, butter, and cheese, every exertion on behalf of the dairy should have been encouraged?" &c.

In some remarks on this letter by Mr Billingsley, the same superiority of dairy farms to the arable kind is asserted in the most positive terms. "Perhaps (says he) there cannot be a stronger proof of the inferiority of the plough with respect to profit, than the superior punctuality of the dairy farmer in the payment of his rent. This observation, I believe, most stewards who superintend manors devoted partly to corn and partly to dairy farms, will verify; at least I have never met with one who controverts it. But perhaps the advocate for the plough will desire me not to confound the abuse of a thing with its intrinsic excellence; and say, that the generality of corn farmers are most egregious slovens; that lands devoted to the plough are not confined to such a mediocrity of profit as 20s. per acre; that the produce of artificial grasses (without which a well managed arable farm cannot exist), far exceeds that of natural grass both in respect of quantity and nutrition: that the straw yard is a most convenient receptacle for the cow when freed from the pail. These, and many other reasons, may be adduced to show the propriety of walking in the middle path, and of judiciously blending *arable* with *pasture*, in the proportion perhaps of *three* of the latter to *one* of the former."

SECT. III. Of the comparative Profit to be derived from the Cultivation of different Vegetables.

LIKE every other artist or tradesman, a husbandman will always be under the necessity of regarding himself as the servant of the community, and must endeavour to rear the vegetables that are in greatest demand, and that will enable him to derive the greatest profit from the portion of territory which he occupies. The product of some soils and situations is so fixed by nature, that it is in vain for human art or industry to alter her destination. In our own and in many other countries, there are extensive tracts of lofty and rugged mountains, from which the art of agriculture seems to be for ever banished. Such situations belong exclusively to the shepherd and his flock, to the utter exclusion of the plough. Even on some arable lands it may be found fruitless to attempt to rear many of the more valuable vegetable productions. In many bleak and unsheltered fields of the higher country of Scotland, in which turnips and oats are cultivated with tolerable success, it would be in vain to expect regular crops of wheat; and

65
Circum-
stances
render
profitable
or not

and though potatoes are found to prosper in a sandy, or even a mossy soil, it would be in vain to expect them to produce an equally valuable crop upon a stiff clay, in which the roots cannot swell or expand to a proper size. In forming a plan of agriculture, therefore, the husbandman must not overlook the peculiar nature of the soil that has fallen to his lot, or its physical relation to the nature of certain vegetables, as he can only hope for success by adapting the one of these to the other.

The husbandman must also have a special regard to the state of the market to which his commodities are to be brought. It is in vain for him to cultivate large quantities of roots, such as potatoes or carrots, at a distance from great towns, which alone can afford a market for them, unless he intend to consume them upon his own farm by feeding cattle. In a part of the country, however, in which great breweries are established, if his soil is fit for the purpose, he may safely venture to rear large quantities of barley; as he cannot in such a situation be at any time destitute of a market. Hence we can perceive, that it is the state of the market which must at all times regulate the enterprises of the agriculturist, and the kind of crops which he is to bring forward. Thus also we see the mode in which agriculture may be most successfully encouraged by a nation. Let an abundant market be provided for the produce of the soil, and that produce will infallibly be augmented. In this way, it is evident that the consumption of grain, by means of distilleries or breweries, is highly favourable to the production of it in great quantities. They are even favourable to the existence of plenty, or of abundance of bread for the use of the people. In good seasons, by affording a ready market, they give activity to the husbandman, and in bad seasons their operations can be arrested by law, and the superfluous quantity of grain which was meant to be consumed by them, can be converted into human food. Thus they operate in some measure like a great public granary, in which provisions should be kept against an accidental scarcity.

It may sometimes happen, that by the character of the age in which he lives, and the state of the market which it produces, a husbandman may find himself most profitably employed, when rearing a kind of food which is by no means the most advantageous to the population of his country. This takes place, when he is employed in preparing butchers meat instead of bread; that is, when he finds it more profitable to rear upon his lands vegetables which can only be consumed by cattle, and thus contribute only in an indirect manner to the sustenance of the human species, than to cultivate those vegetable productions which are suited to the human stomach, and which therefore directly and immediately afford subsistence to man. According to Archdeacon Hislop's Comparative Statement, lately published, the weight of food from an acre of arable land, on the average of three years, a fallow year being included, is nine and a half times greater than from an acre of feeding stock; and according to the calculations of the Rev. Dr Walker, at Collington, professor of natural history at Edinburgh, a Scots acre of land in pasture, fed with sheep, produces only 120 pounds weight of meat, whereas the

same land will yield 1280 pounds of oatmeal, or above ten times as much. Let it even be supposed, then, that one pound of mutton contains in itself as much substantial nourishment for the human constitution, as two pounds weight of oatmeal; still it will follow that lands cultivated for the production of oats, will support a population five times greater in number, than can be supported by the same land when used for the pasture of sheep; and, where one million of people are found to exist upon a territory occupied in the one way, between five and six millions of people might exist upon the same land if it were cultivated for raising grain, and if the inhabitants would consent to use it as their food. Were any contrivance adopted, of the nature of those already mentioned, for converting the succulent roots of potatoes, carrots, &c. into dry meal or flour; the same proportional difference of population would continue to exist, between nations in which that kind of flour should be consumed as human food, and in which it should be used for feeding cattle: For a man always commits an enormous waste of food; who, instead of eating grain himself, gives it to an inferior animal, in the expectation of afterwards receiving an equivalent, by devouring the flesh of that animal.

With these general considerations, however, the practical agriculturist, or husbandman, may have nothing to do. To succeed in his profession, he must accommodate himself to the public taste, or to the state of the market around him; and must consider what commodity, whether grain or butchers meat, will there bring the best reward for his labour. He may even find the state of the market affected by other circumstances, than the mere taste of the public for butchers meat, in preference to vegetable food; although that must always be of great importance among a luxurious people. Conquering nations, who extend their political dominion over distant regions, never fail to draw to their native country a very great portion of the wealth of the vanquished states. The victorious nation never fails, in such cases, to contain a great number of wealthy individuals, whose revenue is not derived from the cultivation of their native soil, or from any branch of manufacture or of commercial industry carried on by them upon it; but which consists of money drawn from the remote provinces of the empire, in consequence of estates possessed, or fortunes acquired there, in the service of government. The result of such circumstances naturally is, that these wealthy individuals not only live at home in a luxurious manner, and increase to an immense extent the consumption of butchers meat by themselves and their numerous retinues; but for the sake of ostentation, and as the only means of employing their wealth, they maintain great numbers of carriages and of riding horses. To support such establishments, they themselves not only convert large tracts of territory from arable into pasture lands; but even the whole husbandmen of the country are induced to do the same, to derive a profit from supplying them with butchers meat, and with food for their pleasure horses. In the mean time, the grain that may be wanted for the consumption of the people, whether rich or poor, being a commodity which is easily preserved and transported, must be bought from foreign nations, by a portion of the superfluous.

Profit from
different
Vegetables.

67
Circumstances
that lead
husbandmen to prefer
pasture to the
rearing of
grain.

Profit from
different
Vegetables.

superfluous wealth of the state; and thus a rich and prosperous people may come to depend upon foreigners for a morsel of bread; and when these foreign nations happen to experience an unfortunate season, this wealthy people may suffer all the horrors of famine upon a fertile soil, and in the midst of overflowing treasures.

Such was the state of Italy under the ancient Romans. Every part of it was adorned with the parks and villas and gardens of the nobles, who derived their revenues from the remote parts of the empire. This seat of dominion exhibited a picture of boundless splendour and magnificence. But the soil was entirely occupied in the service of ostentation or of luxury: and Italy, one of the most fertile corn countries in Europe, depended for grain upon Egypt, and the western provinces of Africa that border upon the Mediterranean. Such also, though perhaps in an inferior degree, seems to be the present state of Great Britain. It has acquired vast and fertile and populous provinces, within the torrid zone in the east, from which individuals are annually transporting home immense treasures obtained in the public service. In the west, also, within the same torrid zone, by a great expense of treasure and of human lives, the cultivation of certain valuable commodities has been established; and from estates situated there, individuals residing at home now derive great revenues. The principles which regulate human affairs are unalterable; and in every age the same causes are attended with the same consequences. What occurred in ancient Italy, took place among us soon as the possession of distant territories had leisure to display its natural effects. Britain formerly not only produced abundance of grain for the support of its own inhabitants, but it possessed a considerable surplus for exportation. After the acquisition of foreign possessions, this surplus produce gradually ceased to exist; and it appears from documents, which the legislature has acknowledged to afford authentic and complete evidence of the truth of the fact, that, for twenty years past, notwithstanding all our agricultural improvements, and the waste lands that have been brought under the plough, the produce of grain is annually becoming more and more unequal to the consumption; and this decrease appears in some measure to keep pace with the increasing value of our distant possessions. In the mean time we are annually coming under the necessity of purchasing larger and larger supplies of grain, from the foreign states of Europe or of North America; and thus these nations, without undergoing the imputation of usurpation, and without encountering the hazard of an unfriendly climate, have been enabled, through the medium of our luxury, to obtain a share of the riches of Hindostan, and of the profits of our West India cultivation. In the mean time their agriculture is encouraged, while we are made to depend upon them for the necessaries of life. After all, it appears unreasonable, and would perhaps be improper, to regret a state of affairs, which is the result of national aggrandisement, and of the superiority and successful enterprise of our countrymen. Still, however, it is obviously to be wished, that, so far as agriculture is concerned, we could be restored to the state of independence which our ancestors enjoyed, when they were able, from their own soil, to supply themselves with the necessaries of life: such a state is sometimes necessary to the independent existence of a community, and is at all times conducive to its welfare. It can only how-

ever be produced by means of agriculture. Therefore,

Ye generous Britons, venerate the *Plough*,
And o'er your hills and long withdrawing vales,
Let autumn spread her treasures to the sun;
So with superior boon may your rich soil,
Exuberant, nature's better blessings pour
O'er every land, the naked nations clothe,
And be th' exhaustless granary of a world!

THOMSON.

SECT. IV. *General Principles of Cultivation.*

IT is not our intention here to enter into a minute disquisition, concerning the nature of vegetables, or the different substances with which they may be connected, in their growth or in their decay. Such investigations, in a proper arrangement of the sciences, ought to be left to chemistry; but even that science, so far as vegetable substances are concerned, is still in such a state of imperfection, that a detail of the experiments and opinions of philosophical chemists, concerning vegetables, would as yet afford but a very trifling portion of useful information to the husbandman. We shall therefore content ourselves with here stating such general remarks, as appear necessarily connected with the important art of which we are now treating.

A vegetable is not to be regarded merely as a piece of matter, or as a mixture of certain material substances. It is an organized being, possessed of life, which it derived from another similar organized being that existed previous to itself; and this former organized and living being derived its constitution from a parent stem, which grew out of a still older plant, up to an antiquity of which we have no knowledge. A vegetable, in this manner, not only has a birth, but it also has a growth, which is supported by food that it takes in and conveys by peculiar organs to the particular parts for which it is destined. When it has arrived at maturity, or reached the perfection of its form and constitution, a vegetable like an animal begins to decay, and finally dies, and, by a process of putrefaction, is converted into a kind of earth.

To the life of vegetables, in the same manner as to the life of animals, the presence of atmospheric air is necessary. They also require a certain moderate degree of heat; without which their growth cannot proceed, although a great degree of it is utterly fatal even to their texture. That they require moisture, is equally obvious; as appears from the ordinary effect of rain, or of the continued want of it, upon fields and plants. They require likewise to be inserted in the earth, or in some way connected with a collection of its particles; for although some plants, particularly the bulbous-rooted kinds, vegetate in pure water and air alone, it appears that they acquire little addition of solid substance, and that neither they, nor any of the other larger plants, reach perfection, or produce seed, unless planted in the earth, or supplied with a portion of it.

As all soils are by no means equally adapted for supporting vegetables, or bringing them to maturity, it is necessary for the husbandman to attend to their nature, and the modes in which they may be altered or ameliorated for his use. Independent of these hard concretions, which obtain the name of stones or rocks,

principles of cultivation. it is to be observed, that the looser and more divisible earth which covers most part of the surface of the globe, and receives the appellation of *the soil*, may, upon the whole, and with sufficient accuracy for practical purposes, be divided into four kinds, which are in general mixed with each other, but which receive their name, in ordinary language, from the kind that predominates or is most abundant. These are sand, clay, chalk, and garden mould. Of these, sand and clay are in some measure the opposites of each other, while chalk forms a kind of medium between them. Sand allows water to filter rapidly through it, and speedily becomes dry, while clay is extremely tenacious of moisture; but a mixture of chalk renders sand considerably more tenacious of water, while it renders clay more loose, and easily penetrated. None of these soils are valuable for the purposes of agriculture.—Sand does not sufficiently retain water for the use of vegetables; nor does clay suffer their roots to expand with freedom in quest of nourishment. Chalk, or, as it is usually called, a calcareous soil, is not of itself adapted for raising useful plants; for, although it may not have the mechanical defects of sand and clay, yet it is found by experience to be of little value to them, either in consequence of its tendency to destroy their texture by its corrosive quality, that is, by having too much chemical affinity with the materials of which they consist, or from its not containing within itself the proper materials necessary to them as food.

The fourth kind of soil we have denominated garden mould; because it is in its highest perfection when it approaches nearest to the rich black earth which receives that appellation. This is the most proper of all kinds of soil for rearing the whole of those vegetables which are accounted valuable in our climate. In proper circumstances, that is, with a moderate degree of heat and of moisture, it never fails to send forth and to bring to perfection an abundant crop. In proportion to the degree in which any soil consists of this black mould, its value increases. If, therefore, a husbandman could cover the portion of territory allotted to him with a tolerable depth of this kind of soil, nothing more would be necessary to the success of his enterprises, as he could rear whatever vegetables he thought fit, in perfection, and in great profusion. It is to be observed, however, that this kind of mould or soil cannot be relied upon as permanent. If crops of grain should be taken from it year after year, it would soon lose its fertile qualities, and become unfit for the purposes of a prosperous agriculture. Here then is the remarkable difference between this kind of soil and the three others that were formerly mentioned, sand, clay, and chalk. Whatever properties these possess are unperishing, and can only be altered or modified by the operation of a fierce heat. Unfortunately, however, in their pure state, as already mentioned, they are of little value to the husbandman; and it is only in proportion to the degree in which they are mixed with the dark coloured or garden mould, that they become adapted to his purposes: but as the qualities of this mould are of a transitory nature, it is of the utmost importance, and ought indeed to form the great basis of every theory of agriculture, to explain how they may be preserved in existence, or restored when lost.

To understand this subject correctly, it is necessary to consider the nature and origin of this fertile mould. It is evidently not one of those original substances which form a part of the great mass of the solid globe of the earth, but appears to be the result of the operations and of the destruction of living and organized beings that have existed upon it. “Were a naked rock, says Mr Headrick, in an essay which we will afterwards have occasion to mention, suddenly thrown up from the sea or from the bowels of the earth, the first plants which nature would place upon it would be the various species of *lichens*, and such as can subsist wholly upon what they imbibe from the air, without needing a soil in which to push their roots. These plants serve the double purpose of clothing the rock, and thus preventing the fine particles that are dissolved by air and moisture from being washed away, and, from their growth and dissolution, of accumulating vegetable soil for the sustenance of more succulent plants. The rock is thus gradually made to acquire such a depth of soil, that it becomes able to sustain not only grasses and shrubs, but may become a receptacle for the oak itself.” The progress here stated is correct; but some circumstances must be added to it, to render it practically useful to the husbandman. It is to be observed then, that animal substances, after they have ceased to form a part of a living body, have a tendency to proceed rapidly into a state of putrefactive fermentation, by which the greatest part of their mass is rendered volatile. When animal substances are mingled with vegetables, they speedily communicate their own fermentation or putrefaction to the vegetables, which by means of it are decomposed, fall to pieces, and are transformed into that kind of black earth, which we have called garden mould, and which forms the most fertile of all soils for the production of vegetables. It is by this process then, that is, by the fermentation of vegetable by means of animal substances, that the surface of this globe has been fertilized, or a black and rich mould produced upon it, as we daily see taking place in a variety of situations. No sooner do the small lichens or mosses cover the face of the naked rock, or gravel, or clay, than a variety of species of small animals appear, and feed upon them. As the plants and animals die in succession, their substances mingle and give rise to the putrefaction already mentioned, which is productive of a small portion of soil. A new race of plants of greater strength and bulk rises upon the ruins of the first, and supports larger animals, all destined in their turn to perish and to increase the quantity of fertile soil. More valuable grasses soon supplant the original small and coarse vegetables, and the spot assumes the appearance of a rich verdure. New species of animals also begin to inhabit it: snails and worms abound; and by their remains contribute to the dissolution of the roots of plants, which everywhere penetrate the new soil, and to the decomposition of the stems which periodically fall down. When the soil has acquired sufficient depth, it is sheltered by shrubs; and, lastly, by forest trees, under the shade of which the larger animals exist. The trees shed their leaves every season, and every season consequently gives an additional layer or *stratum* of fertile mould to the soil: and thus while the forest endures, the fertility of the

Principles of Cultivation. 70 Nature of garden mould. Communications to the Board of Agriculture, vol. ii. 71 Process by which nature fertilizes the earth.

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of
Cultivation.

the territory on which it stands continues to be augmented by its spoils, and by the bodies of the animals which repair to it for shelter.

This process, by which nature gives fertility to the earth, or creates the rich mould on which vegetables flourish, ought to be imitated by the husbandman; and, in fact, it has been imitated in consequence of a knowledge that is derived from experience and from practice, rather than from the general speculations of science. The imitation of nature upon this point constitutes the art of producing manures, which will be afterwards considered. The principle upon which it proceeds, rests upon this foundation, which is known to be true in fact, that the fermentation of animal and vegetable substances produces that kind of dark rich mould which forms the most fertile soil.

In what way, or by what peculiar operation, this kind of mould or soil becomes so highly conducive and subservient to the growth of plants, is a point of more difficult research, and is fortunately of less importance to be known to the practical agriculturist. It may be observed, however, that this mould possesses, in an eminent degree, all the requisites necessary to the success of vegetation. It retains moisture, which is so necessary to that process, without at the same time, keeping hold of it with that retentiveness which, in clay, has the effect of injuring the roots of the plants. As this mould consists of the remains both of animal and vegetable life, it necessarily contains an immense variety of ingredients which have different degrees of chemical affinity to each other. By the operation of these affinities in bringing the different substances into new combinations, a great quantity of heat must be continually produced or evolved, as occurs in so many chemical processes. By this heat the roots of the plants will be nourished, especially when assisted by the heat which they themselves throw out or produce when germinating. Thus by the kind of soil now mentioned, or by the aid of manure, the defects of a cold and ungenial climate may, in some measure, be rectified, and the seeds and roots of vegetables may be supplied with due and seasonable warmth. It is also probable, that what is called the exhausted state of a soil, in consequence of much ploughing, and many crops having been taken from it, may chiefly arise from this circumstance, that all the chemical affinities have at last operated, every particle of the soil remains at rest, and no more heat is produced by the activity of its parts.

That plants growing in fertile mould, like that now mentioned, derive nourishment or food from it, cannot be doubted, since we see, that when taken out of it, or placed in another but less favourable soil, they speedily go into decay. What the particular substances are, however, which they take from it, has not been discovered. But it appears from the minuteness of the extreme fibres of the roots of plants, that the food taken in by them must be soluble in water, or in a liquid state when taken in by them. Accordingly, their food is actually found to ascend through their organs in a liquid form. Of this liquor or sap there are two kinds, the ascending and the descending. The ascending sap is that which rises in the spring; and by cutting a short way through the bark into the wood of many trees, large quantities of it may be drawn off, without injury to their health or growth. This sap ascends to

the leaves, and there undergoes some change by the action of the air: for the leaves of vegetables appear to perform to them an office similar to that which is accomplished in animals by the organ called the *lungs*. From the leaves the sap, thus changed, descends to every part of the plant, and contributes to its growth by becoming a part of its substance. It would seem; however, that the liquors which circulate in plants, not only undergo a change at the leaves, but also at their first entrance by the vessels of the roots; for if several different kinds of trees are ingrafted upon the same common stock, each of them is able to derive the sap peculiar to itself from the sap of the common stock. Thus also the chemists have informed us, that vinegar, called by them the *acetous acid*, is found variously combined in the ascending sap of various trees; but it has never yet been discovered, that vinegar exists in any perceptible quantity in vegetable mould. That substance, therefore, must be formed by the root, by bringing together the ingredients of that acid which it finds and selects in the earth.

When any plant, whether great or small, is put into a close vessel, and strongly heated, allowing only the smoke to escape, the residue is in all cases of the same nature, and is called *charcoal*, or by the chemists *carbon*. Of this carbonaceous matter a considerable quantity is always found in rich garden mould, derived no doubt from the remains of vegetable substances of which that mould was originally formed. This carbonaceous matter, however, or charcoal, being insoluble in water, cannot in its ordinary state enter into the vessels of growing vegetables; but, as it is rendered soluble by a variety of combinations, it is no doubt found out in such a state by the fibres of growing roots, and conveyed upwards in the juice. But as all vegetable mould, and the charcoal or carbonaceous matter which it contains, is the result of the ruins of vegetation, and as the lichens or vegetables of the coarsest and simplest kind, which originally grow upon the naked stone, have no other nourishment than water and atmospheric air, it is probable, that out of these materials they are capable of forming the charcoal, which constitutes the basis of their form, and of the constitution of every other vegetable. It is true, that the chemists still regard carbon or charcoal as a simple and uncompound substance; and they have not found it in water, nor in atmospheric air, unless in the most minute degree, resulting probably from the combustion of fires and the breathing of animals in inhabited countries. But although chemists have not hitherto been able to find charcoal in the three simple substances, oxygen, hydrogen, and azote, of which atmospheric air and water are composed, it seems evident, that the mighty Chemist who contrived this world and the constitution of vegetables, finds no difficulty in forming it of those materials by means of their organization. Hence we rather think, that water and air must constitute the original food of the simplest and coarsest kind of plants; but if this idea be true, it is to be regarded as a fact that is more curious in speculation than useful in practice: for it is certain, that the more valuable and larger vegetables, which it is the business of the husbandman to cultivate, cannot be reared, to perfection without the aid of vegetable mould. Though they may possess, therefore, the power of deriving

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 riving a portion of their solid substance, or of the carbonaceous matter which they contain, from common air and water, they cannot obtain the whole by this means, and require the aid of the remains of former vegetation. It is thus that one system is seen to pervade every part of nature, as through all her works one class of animated beings only enjoys life in consequence of the destruction of another. Thus the carnivorous animals consume those that live upon vegetables; and thus, in like manner, one species of vegetables only subsists upon the ruins, and is fed by the substance, of a former generation of plants.

Besides animal substances, there are some minerals that have a tendency to accomplish the decomposition of vegetables, and thereby to reduce them into the state of mould, possessing in a great degree the qualities of the garden mould that is produced by the fermentation of the remains of animals and vegetables, the formation of which has now been described. Of the minerals that have this tendency, lime is the chief, and indeed the one commonly in use, either pure or when combined with clay under the form of marl. To the effect of lime, therefore, we shall now call the attention of the reader.

Where the ground has been suffered to remain uncultivated for many ages, producing all that time succulent plants which are easily putrefied, and trees, the leaves of which likewise contribute to enrich the ground by their falling off and mixing with it, the soil will in a manner be totally made up of pure vegetable earth, and be the richest, when cultivated, that can be imagined. This was the case with the lands of America. They had remained uncultivated perhaps since the creation, and were endowed with an extraordinary degree of fertility; nevertheless we are assured by one who went to America in order to purchase lands there, that such grounds as had been long cultivated, were so much exhausted, as to be much worse than the generality of cultivated grounds in this country. Here, then, we have an example of one species of poor soil; namely, one that has been formerly very rich, but has been deprived by repeated cropping, of the greatest part of the vegetable food it contained. The farmer who is in possession of such ground, would no doubt willingly restore it to its former state; the present question is, What must be done in order to obtain this end? We have mentioned several kinds of manures which long practice has recommended as serviceable for improving ground: we shall suppose the farmer tries lime or chalk; for, as we have already seen, their operations upon the soil must be precisely the same. This substance, being of a septic nature, will act upon such parts of the soil as are not putrefied, or but imperfectly so; in consequence of which, the farmer will reap a better crop than formerly. The septic nature of the lime is not altered by any length of time. In ploughing the ground, the lime is more and more perfectly mixed with it, and gradually exerts its power on every putrescible matter it touches. As long as any matter of this kind remains, the farmer will reap good crops; but when the putrescible matter is all exhausted, the ground then becomes perfectly barren; and the caustic qualities of the lime are most unjustly blamed for burning the ground, and reducing it to a *caput mortuum*; while it is plain the lime has only done its of-

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 fice, and made the soil yield all that it was capable of yielding.

When ground has been long uncultivated, producing all the time plants, not succulent, but such as are very difficultly dissolved, and in a manner incapable of putrefaction; there the soil will be excessively barren, and yield very scanty crops, though cultivated with the greatest care. Of this kind are those lands covered with heath, which are found to be the most barren of any, and the most difficultly brought to yield good crops. In this case lime will be as serviceable as it was detrimental in the other: for by its septic qualities, it will continually reduce more and more of the soil to a putrid state; and thus there will be a constant succession of better and better crops, by the continued use of lime when the quantity first laid on has exerted all its force. By the continued use of this manure, the ground will be gradually brought nearer and nearer to the nature of garden mould; and, no doubt, by proper care, might be made as good as any: but it will be as great a mistake to imagine, that, by the use of lime, this kind of soil may be rendered perpetually fertile, as to think that the other was naturally so; for though lime enriches this soil, it does so, not by adding vegetable food to it, but by preparing what it already contains; and when all is properly prepared, it must as certainly be exhausted as in the other case.

Here, then, we have examples of two kinds of *poor* soils, one of which is totally destroyed, the other greatly improved, by lime, and which therefore require very different manures; lime being more proper for the last than dung; while dung, being more proper to restore an exhausted soil than lime; ought only to be used for the first. Besides dunging land which has been exhausted by long cropping, it is of great service to let it lie fallow for some time: for to this it owed its original fertility; and what gave the fertility originally, cannot fail to restore it in some degree.

By attending to the distinction between the reasons for the poverty of the two soils just now mentioned, we will always be able to judge with certainty in what cases lime is to be used, and when dung is proper. The mere poverty of a soil is not a criterion whereby we can judge; we must consider what hath made it poor. If it is naturally so, we may almost infallibly conclude, that it will become better by being manured with lime. If it is *artificially* poor, or exhausted by continual cropping, we may conclude that lime will entirely destroy it. —We apprehend, that it is this *natural* kind of poverty only which Mr Anderson says, in his Essays on Agriculture, may be remedied by lime; for we can scarce think that experience would direct any person to put lime upon land already exhausted. His words are,

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 "Calcareous matters act as powerfully upon land that is naturally poor, as upon land that is more richly impregnated with those substances that tend to produce a luxuriant vegetation."

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 "Writers on agriculture have long been in the custom of dividing manures into two classes, viz. *Enriching* manures, or those that tended directly to render the soil more prolific, however sterile it may be; among the foremost of which was dung: *Exhausting* manures, or those that were supposed to have a tendency to render the soil more prolific, merely by acting upon those en-

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riching manures that had been formerly in the soil, and giving them a new stimulus, so as to enable them to operate anew upon the soil which they had formerly fertilized. In which class of stimulating manures, *lime* was always allowed to hold the foremost place.

"In consequence of this theory, it would follow, that lime could only be of use as a manure when applied to rich soils;—and, when applied to poor soils, would produce hardly any, or even perhaps hurtful, effects.

"I will frankly acknowledge, that I myself was so far imposed upon by the beauty of this theory, as to be hurried along with the general current of mankind, in the firm persuasion of the truth of this observation, and for many years did not sufficiently advert to those facts that were daily occurring to contradict this theory.—I am now, however, firmly convinced, from repeated observations, that lime, and other calcareous manures, produce a much greater *proportional* improvement upon poor soils than such as are richer;—and that lime alone, upon a poor soil, will, in many cases, produce a much greater and more lasting degree of fertility than dung."

Thus far Mr Anderson's experience is exactly conformable to the theory we have laid down, and what ought to happen according to our principles. He mentions, however, some facts which seem very strongly to militate against it; and indeed he himself seems to proceed upon a theory altogether different.

78.
Query concerning the nature of a proper soil.

"Calcareous matter alone (says he) is not capable of rearing plants to perfection;—mould is necessary to be mixed with it in certain proportions, before it can form a proper soil. It remains, however, to be determined, what is the due proportion of these ingredients for forming a proper soil.

"We know that neither chalk, nor marl, nor lime, can be made to nourish plants alone; and soils are sometimes found that abound with the two first of these to a faulty degree. But the proportion of calcareous matter in these is so much larger than could ever be produced by art, where the soil was naturally destitute of these substances, that there seems to be no danger of erring on that side. Probably it would be much easier to correct the defects of those soils in which calcareous matters superabound, by driving earth upon them as a manure, than is generally imagined; as a very small proportion of it sometimes affords a very perfect soil. I shall illustrate my meaning by a few examples.

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Examples of soil perpetually fertile.

"Near Sandside, in the county of Caithness, there is a pretty extensive plain on the sea coast, endowed with a most singular degree of fertility. In all seasons it produces a most luxuriant herbage, although it never got any manure since the creation; and has been from time immemorial subjected to the following course of crops.

- "1. Bear, after once ploughing from grass, usually a good crop.
- "2. Bear, after once ploughing, a better crop than the first.
- "3. Bear, after once ploughing, a crop equal to the first.
- "4. 5. and 6. Natural grass, as close and rich as could be imagined; might be cut, if the

possessor so inclined, and would yield an extraordinary crop of hay each year.

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"After this the same course of cropping is renewed. The soil that admits of this singular mode of farming, appears to be a pure incoherent sand, destitute of the smallest particle of vegetable mould; but, upon examination, it is found to consist almost entirely of broken shells: the fine mould here bears such a small proportion to the calcareous matter, as to be scarce perceptible, and yet it forms the most fertile soil that ever I yet met with.

"I have seen many other links (downs) upon the sea shore, which produced the most luxuriant herbage, and the closest and sweetest pile of grass, where they consisted of shelly sand; which, without doubt, derive their extraordinary fertility from that cause.

"A very remarkable plain is found in the island of Jir-eye, one of the Hebrides. It has been long employed as a common: so that it has never been disturbed by the plough, and affords annually the most luxuriant crop of herbage, consisting of white clover and other valuable pasture grass, that can be met with anywhere. The soil consists of a very pure shelly sand.

"From these examples, I think it is evident, that a very small proportion of vegetable mould is sufficient to render calcareous matter a very rich soil. Perhaps, however, a larger proportion may be necessary when it is mixed with clay than with sand; as poor chalky soils seem to be of the nature of that composition."

To these examples brought by Mr Anderson, we may add some of the same kind mentioned by Lord Kames. His lordship having endeavoured to establish the theory of water being the only food of plants, though he himself frequently deviates from that theory, yet thinks it possible, upon such a principle, to make a soil perpetually fertile.

"To recruit (says he), with vegetable food, a soil impoverished by cropping, has hitherto been held the only object of agriculture. But here opens a grander object, worthy to employ our keenest industry, that of making a soil perpetually fertile. Such soils actually exist; and why should it be thought, that imitation here is above the reach of art? Many are the instances of nature being imitated with success. Let us not despair while any hope remains; for invention never was exercised upon a subject of greater utility. The attempt may suggest proper experiments: it may open new views; and if we fail in equalling nature, may we not, however, hope to approach it. A soil perpetually fertile must be endowed with a power to retain moisture sufficient for its plants, and at the same time must be of a nature that does not harden by moisture. Calcareous earth promises to answer both ends: it prevents a soil from being hardened by water; and it may probably also invigorate its retentive quality. A field that got a sufficient dose of clay marl, carried above 30 successive rich crops, without either dung or fallow. Doth not a soil so meliorated draw near to one perpetually fertile? Near the east side of Fife, the coast for a mile inward is covered with sea sand, a foot deep or so; which is extremely fertile, by a mixture of sea shells reduced to powder by attrition. The powdered shells, being the same with shell marl, make the sand retentive of moisture; and yet no quantity of moisture will unite the sand into a solid body. A soil so mixed seems to be

principles of cultivation. be not far distant from one perpetually fertile. These, it is true, are but faint essays ; but what will not perseverance accomplish in a good cause ?”

Having thus, in a manner, positively determined with Mr Anderson, that no dose of calcareous matter can possibly be too great, we cannot help owning ourselves surprised on finding his lordship expressing himself as follows : “ An overdose of shell marl, laid perhaps an inch, and an inch and an half, or two inches thick, produces, for a time, large crops : but at last it renders the soil a *caput mortuum*, capable of bearing neither corn nor grass ; of which there are too many instances in Scotland. The same probably would follow from an overdose of clay marl, stone marl, or pounded limestone.”—To account for this, he is obliged to make a supposition directly contrary to his former one ; namely, that calcareous matter renders the soil *incapable* of retaining water. This phenomenon, however, we think is solved upon the principles above laid down, in a satisfactory manner, and without the least inconsistency.

As to rendering soils perpetually fertile, we cannot help thinking the attempt altogether chimerical and vain. There is not one example in nature of a soil perpetually fertile, where it has no supply but from the air and the rain which falls upon it. The above recited examples can by no means be admitted as proofs of perpetual fertility. We know, that the grass on the banks of a river, is much more luxuriant than what grows at a distance : the reason is, that the water is attracted by the earth, and communicates its fertilizing qualities to it ; but was the river to be dried up, the grass would soon become like the rest. Why should not the ocean have the same power of fertilizing plains near its shores, that rivers have of fertilizing small spots near their banks ? We see, however, that it hath not : for the sea shores are generally sandy and barren. The reason of this is, that the waters of the ocean contain a quantity of loose acid * ; and this acid is poisonous to plants : but abstracting this acid part, we hesitate not to affirm, that sea water is more fertilizing than river water. It is impossible to know how far the waters of the ocean penetrate under ground through a sandy soil. Where they meet with nothing to absorb their acid, there the ground is quite barren ; but in passing through an immense quantity of broken shells, the calcareous matter, we are very certain, will absorb all the acid ; and thus the soil will be continually benefited by its vicinity to the ocean. All the above fields, therefore, are evidently supplied with nourishment from the ocean : for if the salt water has sufficient efficacy to render fields which are in its neighbourhood barren, why should it not render them fertile when the cause of barrenness is removed from its waters ?

After all, the field in Caithness, mentioned by Mr Anderson, seems to have been perpetually fertile only in grass ; for though the second year it carried a better crop of bear than it did the first, yet the third year the crop was worse than the second, and only equal to the first. Had it been ploughed a fourth time, the crop would probably have been worse than the first. Ground is not near so much exhausted by grass as corn, even though the crop be cut and carried off ; and still less if it only feeds cattle, and is manured by their dung ; which appears to have been the case with this field.

Lord Kames, indeed, mentions fields in Scotland, that, past memory, have carried successive crops of wheat, pease, barley, oats, without a fallow, and without manure ; and particularises one on the river Carron, of nine or ten acres, which had carried 103 crops of oats without intermission and without manure : but as we are not acquainted with any such fields, nor know any thing about their particular situation, we can form no judgment concerning them.

Besides the two kinds of soils above mentioned, there are others, the principal ingredient of which is clay or sand. The first of these is apt to be hardened by the heat of the sun, so that the vegetables can scarce penetrate it in such a manner as to receive proper nourishment. The second, if it is not situated so as to receive a great deal of moisture, is very apt to be parched up in summer and the crop destroyed ; nor has it sufficient adhesion to support plants that have few roots and grow high. From these opposite qualities, it is evident that these two soils would be a proper manure for one another : the clay would give a sufficient degree of firmness to the sand, and the sand would break the too great tenacity of the clay. According to Dr Home’s experiments, however, sand is the worst manure for clay that can be used. He recommends marl most. To reduce clay ground as near as possible to the form of pure vegetable mould, it must first be pulverized. This is most effectually performed by ploughing and harrowing, but care must be taken not to plough it whilst too wet, otherwise it will concrete into hard clots which can scarcely be broken. After it is pulverized, however, some means must be taken to keep it from concreting again into the same hard masses as before. According to Lord Kames, though clay, after pulverization, will concrete into as hard a mass as before, if mixed with water ; yet if mixed with dunghill juice, it will not concrete any more. Lime also breaks its tenacity, and is very useful as a manure for this kind of soil.

The conclusion we wish the practical farmer to draw from our theory is, That there is a certain limit to the fertility of the earth, both as to duration and to degree, at any particular time : that the nearer any soil approaches to the nature of pure garden mould, the nearer it is to the most perfect degree of fertility ; but that there are no hopes of keeping it perpetually in such a state, or in any degree of approximation to it, but by constant and regular manuring with dung. Lime, chalk, marl, &c. may be proper to bring it near to this state, but are absolutely unfit to keep it continually so. They may indeed for several years produce large crops ; but the more they increase the fertility for some years, the sooner will they bring on an absolute barrenness ; while regular manuring with plenty of dung will always ensure the keeping up the soil in good condition. What we have said concerning the use of lime, &c. applies likewise to the practice of frequent ploughing, though in a less degree. This tends to meliorate ground that is naturally poor, by giving an opportunity to the vegetable parts to putrefy ; but when that is done, it tends to exhaust, though not so much as lime. A judicious farmer will constantly try to keep his lands always in good condition, rather than to make them suddenly much better ;

lest

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82 Clay and sandy soils.

83 Fertility of the earth limited.

Vegetables lest a few years should convince him that he was in reality doing almost irreparable mischief, while he fancied himself making improvements.

Meliorating the Soil.

SECT. V. *Of the different kinds of Vegetables proper to be raised with a view to the Melioration of Soil.*

84
Soil pulverized by certain vegetables.

THE methods of meliorating soils, which we have mentioned above, consisting of tedious and laborious operations that yield no return at first, it is natural for a farmer to wish for some method of meliorating his ground, and reaping crops at the same time. One very considerable step towards the melioration of ground is its pulverization. This is accomplished by repeated ploughings (s), as already mentioned; especially if performed in autumn, that the ground may be exposed to the winter's frost: but these ploughings yield no crop as long as the field is not sown. By planting in the field, however, those vegetables whose roots swell to a considerable bulk, the ground must constantly be acted upon by the swelling of their roots in all directions: and thus the growing of the crop itself may be equal, or superior in efficacy to several ploughings, at the same time that the farmer enjoys the benefit of it. The plant most remarkable for the swelling of its roots is the potato. They are not, however, equally proper for all soils. In clay they do not thrive, nor are palatable; but in hard gravelly or sandy soils, they grow to a large size, and are of an excellent quality. Turnips likewise contribute to meliorate the ground, by the swelling of their roots. In clay ground, pease and beans thrive exceedingly well, and therefore are proper in this kind of soil as a preparatory for other kinds of grain. These push their roots deep into the ground, and cover it with their leaves, so that the sun has not so much access as when it is covered with crops of grain. Wherever any of these kinds of vegetables are raised, it is observable, that more or less blackness is communicated to the soil: an evident sign of its melioration; this being the colour of the true vegetable mould, or *loamy soil*, as it is called.

Besides the above-mentioned plants, carrots, parsnips, cabbages, and all those vegetables which sink their roots deep in the ground, answer the same purpose of loosening and pulverizing the earth: but as they will not thrive but on ground already well cultivated, they cannot be raised to any advantage for the purpose of meliorating a poor soil.

It has been customary in many places, particularly in England, to sow turnip, pease, buck-wheat, &c. and then to plough them down for manuring the land. This being similar to that operation of nature by which she renders the uncultivated soils so exceedingly fertile, cannot fail of being attended with singular advantages.

In addition to this, it may be proper to remark, that an idea has been entertained with regard to the succession of vegetables to each other, which ought not to be overlooked, as at some future period it may lead to important consequences. It has been supposed,

that the roots of plants, or at least of some plants, possess a power of throwing out, as excrementitious, a part of the substances which they have taken in, but which are no longer necessary for their subsistence or growth. It is undoubted, at least, that while by some plants the soil seems to be rendered altogether unfit for the production of certain others, it is rendered by different plants extremely well adapted to their growth. Thus wheat succeeds uncommonly well after drilled beans; and these two vegetables have even been repeated for a great number of years in rotation, without any deficiency or failure of crop.

SECT. VI. *Of destroying Weeds.*

WHAT we have already said regarding the cultivation of the soil, respects only the fitting it for producing all kinds of vegetables indiscriminately. Experience, however, shows, that the ground is naturally much more disposed to produce and nourish some kinds of vegetables than others; and those which the earth seems most to delight in, are commonly such as are of very little use to man; but if neglected, will increase to such a degree, as entirely to destroy the plants intended to be raised, or at least hinder them from coming to perfection, by depriving them of nourishment. The clearing the ground of weeds, therefore, is an article no less necessary in agriculture, than the disposing it to produce vegetables of any kind in plenty.

The weeds may be divided, according to the time of their duration, into *annual*, or such as spring from a seed, and die the same year; and *perennial*, that is, such as are propagated by the seeds, and last for a number of years. The first kind are the least noxious, and most easily destroyed. For this purpose it will be sufficient to let them spring up till near the time of ripening their seed, and then plough them down before it comes to maturity. It is also of service to destroy such weeds as grow in borders or neglected corners, and frequently scatter their seeds to a great distance; such as the thistle, dandelion, rag-weed, &c. for these are sufficient to propagate their species through a deal of ground; as their seeds are carried about with the wind to very considerable distances. A farmer ought also to take care, that the small seeds of weeds, separated from corn in winnowing, be not sown again upon the ground; for this certainly happens when they are thrown upon a dunghill; because, being the natural offspring of the earth, they are not easily destroyed. The best method of preventing any mischief from this cause, would be to burn them.

Perennial weeds cannot be effectually destroyed, but by removing the roots from the ground, which is often a matter of some difficulty. Many of these roots strike so deep in the ground, that they can scarcely be got out. The only method that can be depended upon in this case, is frequent ploughing, to render the ground as tender as possible; and harrowing with a particular kind

(s) This, however, must be understood with some limitation; for it appears from experience, that many *light* and *thin* soils receive detriment rather than advantage from frequent ploughings; particularly in summer, when the sun exhales the nutritive particles in great abundance.

destroy-kind of harrow, which shall hereafter be described, in order to collect these pernicious roots. When collected, they ought to be dried and burnt, as the only effectual method of ensuring their doing no further mischief.

There is a particular species of weed, peculiar only to grass lands of a soft spongy nature, called *fog*, which it is found very difficult to exterminate. This weed may be destroyed by lime, and passing a heavy roller over the ground will be of great service; for fog owes its origin to too great a laxity of the soil, and will not grow on firm ground.

Besides these kinds of weeds which are of an herbaceous nature, there are others which are woody, and grow to a very considerable size; such as broom, furze or whins, and thorns. *Broom* is an evergreen shrub, that thrives best in a sandy soil; and there it grows so vigorously, as scarcely to admit any grass under it. It propagates by seed which grows in pods; and these, when fully ripe, break with violence, scattering the seeds all around. Thus, a field which is overgrown with broom, besides the old plants, always contains an infinite number of young ones: so that though the old plants die when cut over, a fresh crop constantly springs up. It may, however, be destroyed by frequent ploughing and harrowing, in the same manner as other perennial weeds are; for it does not for some time carry any seed, and the frequent ploughing encourages the vegetation of all those seeds that are already in the ground, which cannot fail of being destroyed by frequent repetitions of the operation. Another method of destroying broom, is by pasturing the field where it grows with sheep. A few of the old bushes may be left as a shelter, and these will be in a good measure prevented from spreading by the cropping of the sheep. These animals are very fond of broom, and greedily devour every young shoot; so that if any remain after the first year, there will not be a vestige the second. If this method of extirpating broom is equally effectual with that of frequent ploughing, it is certainly much more profitable, as there is no food more nourishing to sheep than young broom. Broom, however, is said to have a singular effect upon sheep; it makes them drunk so effectually, that when heated with a little driving, they tumble over, and lie without motion.

The *whin* is a fine evergreen shrub, carrying a sweet-smelling flower all the year round. It propagates both by seed and by its roots, which spread sometimes to the distance of 10 or 12 feet; and hence, when once established, it is with difficulty extirpated. The best method is to set fire to the whins in frosty weather; for frost has the effect to wither whins, and make them burn readily. The stumps must then be cut over with a hatchet; and when the ground is well softened by rain, it may be ploughed up, and the roots taken out by a harrow adapted to that purpose. If the field is soon laid down to grass, the whins will again spring up in great abundance from the seeds, and small parts of the roots left in the ground. In this case, pasturing with sheep is an effectual remedy; as they are no less fond of young whins than of young broom; and if there are a sufficient number, they will not leave a single plant above ground. But if grass is not immediately wanted, the most effectual method of clearing a field of whins, is by reiterated ploughings.

The *thorn*, or *bramble*, spreads its roots very wide, and at the same time sinks them deep in the earth. Though cut in winter, it rises and comes to such perfection as to carry fruit in summer. It can only be extirpated by ploughing up the ground and collecting the roots.

One effectual plan, which, as will afterwards appear, is practicable in many more situations than it has hitherto been applied to, for destroying these and all other woody shrubs and plants, together with a great number of weeds, that are of no value upon pasture grounds, consists of flooding the land, by directing over it a stream of water. By means of such a device, all whins and other shrubs are completely rotted and destroyed.

SECT. VII. Of the Diseases of Plants.

As some of the most valuable kinds of vegetables are liable to suffer much by diseases peculiar to themselves, it is of much importance to the husbandman to be aware of this circumstance, and to adopt every known mode of protecting his crop against them. At the same time, as the principles of vegetable life are by no means well understood, the causes and the cure of the most serious diseases affecting plants still remain under a great degree of obscurity, and the most experienced and intelligent husbandmen express great uncertainty respecting the measures to be adopted for preventing their appearance. Hence it appears most proper to introduce the consideration of them in this place before we proceed to the practical part of the subject; and as wheat is accounted the most valuable kind of grain, we shall begin with the diseases to which it is exposed.

Wheat chiefly suffers from two diseases, the blight and the mildew. Of the blight in wheat we shall give an account upon the authority of an essay by Robert Somerville, Esq. surgeon, 1st Battalion 8th Fencible Regiment, inserted in the communications to the Board of Agriculture*, giving a statement of the nature and appearance of the blight which occasioned the failure of the crop in 1795.—When the crop had just shaken the flowers, and the grains were beginning to form, most of them seemingly in a healthy manner, it was observed that many of the blades and stalks were rather of a dirty green colour, and in two weeks thereafter there appeared upon them great numbers of small red insects. As the season advanced, these insects not only increased in size, but became more numerous, and in almost every field the grain began to manifest unequivocal symptoms of disease, which were so formidable, that in many instances a total loss was dreaded, and in not a few cases, one-half of the crop was actually destroyed. The minute symptoms of the blight were these:

1st, In the very early stages of the disease, and before the ear was affected, the blades and stalks were marked with black and rusty spots. These spots seemed to be occasioned by a glutinous substance deposited upon them, easily soluble in water, and which could be readily washed off by rubbing the stalks with a wet cloth. Some spots, however, were white, and these seemed to be owing to wounds or punctures made by vermine; the leaf having, to a certain extent, in consequence of these,

Diseases of Plants. of these, withered and become white. As the season advanced, the black and rusty-coloured spots became larger and more numerous: and when the grain began to ripen, not only the blades but the straw were almost entirely coloured with black spots.

2d, After the crop had begun to shoot, and was in the ear, many of the heads were entirely empty. Where the stalk was green, and to appearance tolerably healthy, but the ear at the same time withered and without grain, the misfortune seemed to have arisen from an injury done to the neck of the ear, at the place of its junction with the stalk. There the outer rind was destroyed all round, which must have cut off the circulation between the ear and the stalk, as happens in trees that have had their bark destroyed all round.

3d, Many of the ears were entirely empty in the upper part, while the lower half was well filled. In these cases, the injury seemed owing to the rind being destroyed about the middle of the ear, at that place which separated the full from the empty part, and was similar to the injury done in the preceding case where the whole ear was destroyed.

4th, In very many cases the ears had a plump well-filled pickle and an empty husk alternately. In these the injury seemed owing to a wound inflicted at the bottom of the empty grains, where they are joined to the stalk, and which had taken place while they were in flower, preventing them from making any farther progress.

5th, Many ears, though not entirely empty, contained only small shrivelled grains, or what are called hungry pickles. These seemed to have escaped any accident till they had made some progress in filling, after which they become stationary and ripened prematurely. On examination they were found to be injured at the place where they were joined to the stalk, in the same manner, as was already mentioned, in the case of those that had empty heads or ears. Like these also the whole ear was in some cases ill filled. In others only half of it was in that state, and in a very great number the ears consisted of a well and ill filled grain alternately. Without a single exception, the whole of the ill filled or hungry grains, were wounded at the place of their insertion into the ear.

6th, A number of ears, though well filled, were upon opening the husks found almost entirely covered with black and rusty spots, nearly resembling those already described, and like them also they were easily rubbed or washed off. The downy part of many of these grains, when examined carefully with a good glass, appeared to contain several small white transparent globes, resembling the eggs of insects.

7th, In many fields, especially such as had been fallowed and well manured for the wheat crop, a great number of plants were entirely withered from top to bottom. The decay in most of these cases, took place when the wheat was beginning to shoot. No injury was visible in these cases upon the blade or stalk, but on examining the roots, a worm was found at every one of them.

Lastly, As the crop began to whiten, the dark or rusty spots on the straw and ears became more numerous, and appeared more conspicuous. In place of put-

ting on a white or yellow appearance, the whole crop looked as if it had been sprinkled with soot.

The whole of these symptoms appeared to arise from the attack of an insect, and from the injuries and depredation which it committed upon the plants. This insect, when first distinguishable by the eye, was of a red colour, and so soft as to be killed by the slightest pressure. As it increased in size the colour gradually changed to a dirty black, at which it became stationary. During its growth it lost its soft texture, and in proportion as its colour darkened it became hard, and as it were covered with a crust or shell upon the back. It is said to be not uncommon, and to be met with at all times, even in the best fields of wheat, though its numbers are infinitely increased in late wet seasons. From its eggs appearing to lodge upon the well-filled ears of the grain, it may be considered as in danger of being propagated to the succeeding crop. On this account our author hazards some conjectures upon the best means of preventing future danger from it. One of these consists of the use of lime mixed up with all manure, with a view to prevent insects from being generated in it. It is also suggested that the manure, by means of which slugs and worms are chiefly supposed to be produced, ought not to be plowed into the ground in autumn, but applied as a top-dressing in the spring; because it is understood that manure, exposed to the sun and air, has much less tendency to foster insects, than when it is covered up in the earth.

Another disease, which is much more destructive to wheat, and much more frequently met with, is the mildew. It is of two kinds, the black and the red. In both cases it consists of a quantity of seemingly coarse powder attached to the grain in the ear, or loosely surrounding it; in consequence of which it is evidently prevented from filling or arriving at perfection. The black kind of mildew is by far the most frequent and the most pernicious. It is most generally known in England by the name of *smut*, and in Scotland by that of the *black*, both of which are sufficiently expressive. Concerning the cause of this disease various opinions have been entertained. Dr Home, in his *Principles of Agriculture and Vegetation*, ascribes it to an overluxuriance of growth. He is of opinion, that too great an abundance of juices in a vegetable will produce diseases similar to those occasioned by repletion in animal bodies, viz. stagnations, corruptions, varices, cariosities, &c. along with the too great luxuriance we have just now mentioned, which he expresses by "too great an abundance of water shoots." Hence he is induced to class the smut among diseases arising from this cause, it being a corruption happening most in rainy seasons and to weak grain. Like other contagious diseases, he tells us, the smut may be communicated from the infected to healthful grain. As a preventive he recommends steeping the seed in a strong pickle of sea salt. Besides the effect which this has upon the grain itself, it is useful for separating the good from the bad; the best seed falling to the bottom, and the faulty swimming on the top of the liquor.

Independent of this notion of an over luxuriance of growth, it may be observed, that two opinions have chiefly been supported by persons who have speculated and written on this subject. One opinion is, that the mildew

Disease Plant

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cases of mildew consists of a great multitude of parasitical plants adhering to the grains of wheat, living upon it, and thereby consuming its substance. Another opinion is, that it consists of great numbers of insects and of eggs of insects, whose form is too small to be distinguishable by the naked eye. The first of these opinions has been adopted by the celebrated Italian writer Fontana, and the other by certain writers of our own country.

Fontana endeavours to refute the hypothesis, that the dust of the mildew consists of animal eggs, by the following experiment. He closely confined the grains of the mildew between two glass plates, in such a manner as necessarily to break the supposed eggs. He then, with an accurate microscope, observed them while crushed in succession. No liquid or glutinous juice proceeded from them, though great force was used in crushing them; but they appeared wholly to consist of tough resisting substances altogether unlike real animal eggs: their being fastened to the stalks or leaves of the grain, appeared also to militate against such a supposition. From a variety of microscopic observations, he is of opinion, that the powder of the black mildew or smut consists of a great multitude of small plants attached to the grain by a slender fibre. These parasitical plants, though extremely small, he thinks sufficiently regular. With regard to the red mildew, he admits, that it appears to be composed of an immense multitude of minute eggs. After a variety of experiments and observations, however, he thought he discovered, that these apparent eggs are in truth the heads or fruit of very fine threads fixed on the ear of corn; that these threads or stems are exceedingly fine and transparent, which gives the appearance of eggs to their outward extremities. These stems or tails are represented by him, as infinitely finer than those of the black mildew; and their heads, which resemble eggs, may be separated from them by the slightest shock. From all his observations he concludes, that both the black and the red mildew consist of real plants, though, perhaps, of an imperfect kind; and that they enfeeble and waste the crop by absorbing the nutritive juices of the plant. He observes, that, if a heavy rain speedily fall on an extensive mildew, washing the leaves and stalks affected, it presently disappears with hardly any damage to the corn; because the small plants having hardly taken root are easily dispersed before any mischief is done. He thinks, that the damage occasioned by this disease may sometimes be moderated or diminished by cutting down the grain before it is fully ripe. In this case, he says, that the crop will be less than it ought to be; but still it will be considerably greater than if the customary time of harvest is waited for, when the disease will have leisure to produce greater mischief.

In our own country, and particularly by Mr Somerville, in the essay already quoted, the smut in wheat has been regarded as consisting of a great variety of insects. He also founds his opinion upon microscopic observations, and apprehends that from them he has clearly ascertained the existence of the insects; and he thinks that it is communicated to other grain by contact, in consequence of the passage of the insects. Hence he endeavours to explain the utility of steeping the seed in

pickles before it is sown, with a view to the destruction of such insects.

It is to be remarked, that in all countries a great variety of these pickles has been contrived, with a view to prevent the existence of smut in wheat, some of which we shall now mention. One of the most common is the salt pickle, consisting of a solution of common salt in water, of such strength as that an egg will swim in it. To the wheat, after it has been washed in this pickle, and the light grains removed, some new slaked lime is added, and carefully mixed with it with a wooden shovel, till it attain a sufficient degree of dryness, in which state it is committed to the earth. A pickle consisting of very stale urine has also been recommended to be used for washing wheat that is meant to be used as seed. It is attended with this disadvantage, however, that if the urine is very stale, and if any length of time is suffered to elapse, in consequence of rain or other accidents, before the grain is sown, its vegetative power is said to be greatly injured by the corrosive quality of the volatile alkali with which such urine abounds. This is more particularly the case when quicklime is added to the urine; as the alkali is then brought into a caustic state.

Another pickle has been proposed to the Board of Agriculture by an Italian physician, J. B. Scandella. It is prepared and used in the following manner:—Take of nitre, three pounds; alum, one pound; vitriol, six ounces; verdigris, three ounces; wood-ashes, well sifted, six pounds: Boil the whole in a copper with five pails of water for an hour, then remove them from the fire, and pour them into a large vessel; then add sixteen pails of water, in which half a bushel of quicklime has been previously dissolved: mix the whole intimately, and allow them to stand till they are quite cold. In this steep two bushels and a half of wheat are to be plunged, and left for about six hours, stirring it up frequently with a wooden shovel, and skimming off what rises to the surface; the wheat is then to be withdrawn, and spread out till it is dry enough for sowing. The process is thus to be continued until the whole quantity of seed intended to be sown is pickled. The above steep is generally sufficient for preparing about twenty-four bushels of wheat.

Another pickle has been recommended, consisting of a decoction in water of Barbadoes aloes, tobacco, and hellebore powder. A committee of the Royal Society of Agriculture at Paris, in 1786, recommended the following pickle for the same purpose, contrived by M. Tillet:—Pour upon 50 pounds of wood-ashes, 900 pints of water; stir it well for three days, and then draw off. Wash the black wheat in so many clear waters as not at last to dirty it. Heat the lye, so as just to bear the hand in it; slake in the hot lye one pound of lime to every seven or eight pints of it. In the preparation dip the seed in baskets many times. For want of wood-ashes use potash, seven or eight pounds for 100 pints of water.

In addition to these it may be remarked, that a solution of arsenic in water is made use of in some counties of England, as a pickle in which they wash or steep the grain previous to its being sown, for the purpose of protecting the future crop against smut.

The most complete set of experiments, however, which

Diseases of which we have met with upon the subject, was made by Arthur Young, Esq. at present secretary to the Board of Agriculture. December 7. 1787, he sowed 14 beds with the same seed wheat as black with the smut as any he ever saw.

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Arthur Young, Esq.
his experi-
ments to
prevent
mildew.

- N^o 1. Sown dry, nothing done to it.
2. Washed well in clean water.
3. Washed in lime-water.
4. Washed in lye of wood ashes.
5. Washed in an arsenic and salt mixture.
6. Steeped in lime-water four hours.
7. Ditto in the lye four hours.
8. Ditto in the arsenic four hours.
9. Ditto in lime-water 12 hours.
10. Ditto in the lye 12 hours.
11. Ditto in the arsenic 12 hours.
12. Ditto in the lime-water 24 hours.
13. Ditto in the lye 24 hours.
14. Ditto in the arsenic 24 hours.

RESULT.

N ^o 1. Had	377 smutty ears.
2. Ditto	325
3. Ditto	43
4. Ditto	31
5. Ditto	28
6. Ditto	12
7. Ditto	3
8. Ditto	1
9. Ditto	6
10. Ditto	0
11. Ditto	4
12. Ditto	0
13. Ditto	0
14. Ditto	5

A proposal has also been made, to destroy by means of heat the insects which are supposed to propagate the disease called *smut* from the seed wheat to the future crop. The following directions for that purpose are extracted from the Agricultural Survey of the County of Clackmannan, by J. F. Erskine, of Marr, Esq. "Let the wheat be laid upon the kiln, about three or four inches thick: the kiln to be heated middling strong with blind coal; the wheat to continue on the kiln for 24 hours, but turned frequently. After taking it off the kiln, it must be allowed 24 hours to cool; during which time it must be frequently turned; then put it through the fanners once or twice. After the wheat has lain a few hours on the kiln, and the fire begins to have effect, a great number of very small worms, formerly undiscovered by the eye, appear on the top of the grain, and are soon destroyed by the heat. These come from blacked wheat, or other corns, that could not be suspected to be indifferent; or may lie in or on good wheat; which worms continuing (when not thus killed), might consume the corn after it is thrown into the earth, thereby checking the growth entirely, or preventing it from having the strength it otherwise would have to bring forth a strong productive stalk. This practice is said to have been brought from Ireland, and is recommended as preferable to pickling. It might perhaps be performed with greater success by the use of a kiln heated by the steam of boiling water, in the way already mentioned, as such a kiln would

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Erskine of
Marr's re-
medy.

instantly afford a fixed and known degree of heat which could in no case be exceeded."

Diseases of
Plants.

After all, however, both from the reason of the thing, and from the concurring opinion of the most experienced and intelligent farmers, we think ourselves authorized to say, that the husbandman will act imprudently if he place entire and complete confidence in any one of the remedies above mentioned. His safest and best plan for procuring crops of wheat free from smut is this: In the first place, he ought to procure seed from a situation in which the grain has risen absolutely free from this disease. He ought next to exert the greatest care in cleaning out, in the most anxious manner, his whole barns and their floors, and every place within doors into which his grain may come, and in which diseased grain has formerly been kept: with this view it may probably be necessary to whitewash the walls with a mixture of quicklime and water, which will prove an effectual remedy. After having adopted these precautions, it may still be necessary, with a view to secure a sound and full crop, to plunge the seed into a strong pickle of salt and water, with a view to float the lighter grains, which ought to be skimmed off and laid aside for poultry, to which they may be given after being washed in fresh water.

The want of nourishment in plants may be easily known by their decay; in which case, the only remedy is, to supply them with food, according to the methods we have already directed, or to remove from their neighbourhood such other plants as may draw off the nourishment from those we wish to cultivate.—In the Memoirs of the Academy of Sciences for 1728, Mr Du Hamel mentions a disease, which he calls *le mort*, that attacks saffron in the spring. It is owing to another plant, a species of trefoil, fixing some violet-coloured threads, which are its roots, to the roots of the saffron, and sucking out its juice. This disease is prevented by digging a trench, which saves all the unaffected.

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Diseases
peculiar to
saffron.

The bad qualities, and unequal distribution of the juices of plants, are the occasion of so few of the diseases to which vegetables in this country are subject, that we forbear to mention them at present. Most of the diseases of our plants are owing to external accidents, particularly to the depredations of insects.—The insects by which the greatest devastations are committed in this country are, snails, caterpillars, grubs, and flies. The snails and caterpillars feed on the leaves and young shoots; by which means they often totally destroy the vegetable. Where the plants are of easy access, these vermin may be destroyed by sprinkling the vegetable with lime-water; for quicklime is a mortal poison to creatures of this kind, and throws them into the greatest agonies the moment they are touched with it. On trees, however, where this method cannot so well be followed, fumigation is the most proper; and, for this purpose, nothing is better than the smoke of vegetables not perfectly dry. In some cases the eggs of these destroying creatures may be observed, and ought without doubt immediately to be taken away. On the fruit trees, as apples, pears, medlars, on some forest trees, the oak and dwarf maple especially, and the white and black thorn in hedges, a kind of little tufts are to be observed, resembling at first sight withered leaves twisted by a cobweb, about the uppermost twigs or branch-

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Vegetables
destroyed
by insects.

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Insects de-
stroyed by
lime-water

cases of es. These contain a vast number of little black eggs, plants. that in the spring produce swarms of caterpillars which devour every thing. To prevent this, all the twigs on which these cobwebs appear should be taken off and burnt as soon as possible. This ought to be done before the end of March, that none of the eggs be allowed sufficient time for hatching.

The grubs are a kind of worms which destroy the corn by feeding upon its roots; they are transformed every fourth year into the beetles called *cockchaffers*, *may-bugs*, &c.; they are very destructive when in their vermicular state, and cannot then be destroyed, because they go deep into the ground. When become beetles, they conceal themselves under the leaves of trees, where they seem asleep till near sunset, when they take their flight. It is only now that they can be destroyed, and that by a very laborious method; namely, by spreading pack-sheets below the trees in the daytime when the beetles are in their torpid state, then shaking them off and burning them. Some time ago they made such devastations in the county of Norfolk, that several farmers were entirely ruined by them; one gathered 80 bushels of these insects from the trees which grew on his farm. It is said, that in 1574 there fell such a multitude of these insects into the river Severn, that they stopped and clogged the wheels of the water-mills.

Turnips, when young, are apt to be totally destroyed by a multitude of little black flies, from thence called the *turnip-fly*. As a preventive of these, some advise the seed to be mixed with brimstone; but this is improper, as brimstone is found to be poisonous to vegetables. The best method seems to be the fumigation of the fields with the smoke of half-dried vegetables. For this purpose weeds will answer as well as any. This fumigation must no doubt be often repeated, in order to drive away the innumerable multitudes of these insects which are capable of destroying a large field of turnips.

Some have supposed that the fly is either engendered in new dung, or enticed by it; and have therefore advised the manure to be laid on in the autumn preceding, by which it loses all its noxious qualities, while its nutritive ones are retained, notwithstanding these might be supposed liable in some degree to be exhaled by the sun. This method is said to have been ascertained by experiments; and it is added, that another material advantage accruing from autumn manuring for turnips is, that all the seeds contained in the dung, and which of course are carried on the land with it, vegetate almost immediately, are mostly killed by the severity of the winter, and the few that remain seldom avoid destruction from the ploughshare.

The following remedies are recommended as having often proved successful:—A small quantity of soot sown over the land at their first appearance. Branches of elder, with the leaves bruised, drawn in a gate over them. Musk mixed with the seed before it is sown. And sulphur burnt under it, after moistening it with water in which tobacco has been steeped.

But showers on the plants, as soon as they appear above ground, are esteemed the best preservatives. They enfeeble and kill the fly, and hasten the plants into the rough leaf, in which state they are out of danger.

The sweet smell of the turnip has been thought to attract the fly; upon which supposition, the remedy appeared to consist in overpowering that smell by one which is strong, fetid, and disagreeable. Hence it has been recommended that upon an acre of turnips sown in the usual way, a peck or more of dry soot be thrown after the ground is finished, and in as regular a way as he sows the seed.

Some time ago an insect, called the *corn butterfly*, committed such ravages while in its vermicular state, in France, that upwards of 200 parishes were ruined by it; and the ministry offered a reward to the discoverer of an effectual remedy against this destroying worm. The cure which was at last discovered was, to heat the corn in an oven so much as not to destroy its vegetative power, but sufficiently to destroy the small worms which made their nest in the substance of the grain, and at last ate out the substance so completely, that nothing could be got from the husk even by boiling it in water. It is certain, that though insects can bear a great deal of cold, they are easily destroyed by a slight degree of heat; nor is the vegetative power of corn easily destroyed, even when kept for a long time in a pretty strong heat. This method must therefore be very effectual for destroying all kinds of insects with which grain is apt to be infected: but care must be taken not to apply too great a heat; and the adjusting of the precise degree necessary to destroy the insect, without hurting the corn, will be attended with some difficulty.

The curled disease in potatoes has long been a subject of investigation and experiment among farmers; and the knowledge of its cause and cure seems yet to remain a desideratum. The Agricultural Society at Manchester, a few years ago, offered a premium for discovering by actual experiment the cause of the disease in question; and a great variety of letters were in consequence addressed to them upon the subject.—As these contain many interesting observations both on the disease itself, and the best methods hitherto adopted for preventing it, the following abstract of them may not improperly be introduced in this place.

I. According to the writer of the first letter, this disease is caused by an insect produced by frost or bad keeping before setting; and the newest kinds, such as have been raised within these nine or ten years, are most apt to curl, because they will not stand to be kept in winter and spring before setting, as the old kinds will. In autumn 1776, he got up a bed of potatoes to lay by in winter, leaving plenty in the ground as regular as possible; and, before the severity of winter came on, covered part of the bed with straw and pease-haulm, and left the other part of the bed uncovered. That part of the bed which was covered was quite free from curled ones; but the uncovered part produced a great many curled, owing, as the writer says, to frost and severity of the weather.

II. This writer had about a quarter of an acre of potatoes, well manured with cow and horse dung, and took the greatest care in picking the fine smooth-skinned potatoes for sets; yet nine out of ten parts were curled. He attributes the cause of this disease to a white grub or insect, which he found near the root, about half an inch long, with eight or ten legs, its head brown and hard; as, upon examining a number of the curled roots,

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Plants.

he found them all bitten, chiefly from the surface to the root, which of course stopped the progress of the sap, and threw the leaf into a curl. The uncurled roots were not bitten. He tried a few experiments as follow:—First, he put soot to the insects in the rows for two days; and after that, he put lime to them for the same time, but they still kept lively; next he put a little salt, which destroyed them in a few hours. From which he infers, that if coarse salt were put into the ground at the time the land is preparing for potatoes, it would effectually cure this distemper.

III. In this letter, the cause of the disease is attributed to the method of earthing the stems while in cultivation; and the branch, striking root into the new earthed-up soil, it is said, produces potatoes of such a nature as the year following to cause the disease complained of.

To prevent the disease, it is recommended to take the sets from those potatoes that have not bred any from the branch covered; or, otherwise, to dig the part the sets are to be raised from.

IV. According to this writer, the disorder proceeds from potatoes being in old-tilled or worn-out ground; for though these potatoes may look tolerably well, yet their sets will mostly, if not all, produce curled potatoes.

Hence he is convinced, that no sets ought to be used from old-tilled or couch-grass land: and that in order to have good sets, they should be procured from land that was purposely fallowed for them; from fresh ley land, where they are not curled; or from ley land that was burnt last spring. He directs to plant them on virgin mould, and the potatoes will have no curled ones amongst them; and to keep them for winter, from any other kind.

To avoid the uncertainty of getting good sets, he recommends crabs to be gathered from potatoes growing this year on fresh land free from curl, and the next spring to sow them on fresh ley land; and continue to plant their sets on fresh ley land yearly, which he is convinced will prevent the curl.

All the good potatoes he saw this year, either on fresh ley land or on old-tilled land, were raised from sets that grew upon fresh ley land last year; and where he has seen curled potatoes, he found, upon inquiry, the potato sets grew upon old-tilled and worn-out land last year. He gives as a general reason for the disorder, that the land is oftener cropt than it had used to be, much more corn being now raised than formerly.

V. In 1772, this writer planted some potatoes by accident full nine inches deep: when taken up, many of the plants were rotted, and a few curled. He kept the whole produce for seed, and planted two acres with it in 1773, not quite six inches deep. The crop was amazingly great; and he did not observe any curled plants among them. In 1774, many of these were planted in different soils; yet they were so infected with the curled disease, that not one in twenty escaped. In 1775, the complaint of this disease became general. In 1776, it occurred to him that the good crop of 1773 was owing to the accidental deep setting of 1772; and that the reason why the same seed became curled in 1774, was their being set so near the surface in 1773; and attributes the disease to the practice of ebb setting. In 1777, he took some potatoes from a crop that was curled the year before, and after cutting

the sets, left them in a dry room for a month. Half were planted in ground dug fourteen days before; the other half, having been steeped in a brine made of whitster's ashes for two hours, were also planted on the same land at the same time. The steeped ones came up ten days before the others, and hardly any missed or were curled. The unsteeped ones generally failed, and those few that came up were mostly curled.

He therefore advised as a remedy, 1. That the potatoes intended for next year's sets be planted nine inches deep. 2. That they remain in the ground as long as the season will permit. 3. That these sets be well defended from frost till the beginning of March. 4. That the sets be cut a fortnight before planting. 5. That they be steeped, as above, two hours in brine or lye. 6. That the dung be put over the sets. And, 7. That fresh sets be got every year from sandy soils near the coast, or on the shore.

P. S. At planting, the hard dry sets should be cast aside, for they will probably be curled. Curled potatoes always proceed from sets which do not rot or putrefy in the ground.

VI. This writer had five drills of the old red potatoes, and four of the winter whites, growing at the same time in the same field. The drills were prepared exactly alike. Among the red not one was curled; the winter whites were nearly all curled. He says he has found by experience, that the red never curl.

VII. Two of the writer's neighbours had their sets out of one heap of potatoes. They both set with the plough, the one early, and the other late, in the season. Most of those early set proved curled, and most of those set late smooth; the latter on clay land.

A few roods of land were also planted with small potatoes, which had lain spread on a chamber floor all the winter and spring till the middle of May. They were soft and withered: they proved smooth and a good crop. Middle-sized potatoes, withered and soft, which had been kept in a large dry cellar, and the sprouts of which had been broken off three times, produced also a smooth good crop.

Hence he was led to think superfluity of sap, occasioned by the seed being unripe, might cause the disease. To be satisfied in this, he asked the farmer whether he had set any of the same potatoes this year, and what was the nature of his land? He told him "he had; that they had been set on his farm fourteen years without ever curling; that his soil was a poor whitish sand, of little depth; that he let those he designed for keeping grow till they were fully ripe."

Hence he concludes, the only sure way to prevent the curl is, to let potatoes intended for seed stand till they are fully ripe, and to keep them dry all winter.

VIII. This writer set a quantity of the red potatoes, without having a curled one amongst them. His method is, when the sets are cut, to pick out such as are reddest in the inside. On digging them up at Michaelmas, he mixes none of the curled seed among the others. The curled are easily distinguished, by their stalks withering two months before the rest of the crop.

The cause of the curled disease he attributes to potatoes being of late years produced from seed instead of roots as formerly. Such will not stand good more than two or three years, use what method you please. Last spring

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cases of spring he set the old red and white russets, and had not a curled potato amongst them.

On the limestone land about Denbigh, in North Wales, they have no curled potatoes. If this be owing to the nature of that land, perhaps lime might prevent the disease.

IX. According to this writer, all sorts of grain wear out and turn wild if sown too long on the same land; the same will hold good in all sorts of pulse, pease, beans, and (as he conceives) potatoes. It generally happens, that those who have most curled potatoes plant very small sets.

Eleven years ago he bought a parcel of fresh sets, of the golden-dun kind, and has used them without change to the present year, without any being curled. This he principally attributes to his having always planted good large sets.

About four years since, he thought of changing his sets, as his potatoes were too smooth, too round, and much diminished in size. But the curl at that time beginning to be very alarming, he continued his sets till part of his crop missing last year, he was obliged to buy new sets this spring, which being small, were curled like other people's.

He allows, that the curl has frequently happened to persons who have used large potatoes for sets; for, as all roots are not equally affected, some curled ones may be mixed with the rest.

To prevent the evil, cut your sets from clear and middle-sized potatoes, gathered from places as clear of the curl as possible; preserve them as usual till spring. If any are harder, or grash more in cutting than usual, cast them aside. He would also recommend the raising a fresh sort from the crab produced on the sorts least affected, which in Lancashire are the long-duns.

X. Set potatoes with the sprits broke off, and they will (says the writer of this letter) be curled ones; if set with the sprits on, they will not be curled. Again, take a potato which is sprit, and cut a set off with two sights; break one sprit off, and let the other stay on, and set it; the former will be curled, and the latter will not.

When you have holed your potatoes, take them out before they are sprit, and lay them dry until you have set or sown them, and you will have no curled potatoes.

XI. This writer was at the expence of procuring sets at 50 miles distance, and where this disease was not known. The first year's trial was successful; the year following he procured sets from the same place, but one-fifth of his crop was infected. By way of experiment, he planted sets from roots which had been infected the year before, and some of these produced healthy plants, free from all infection.

As every effect must have a cause, he supposed it might be some insect, which, living on the leaves, gave them that curled and sickly appearance, as is the case in the leaves of many shrubs and trees. But whether the insect is lodged in the old sets, and to be destroyed at the time of planting, or, proceeding from some external cause, can only be destroyed afterwards, he is not yet certain, although he has made the following experiments.

On a piece of ground that had not been dug for 20 years, he planted four rows of sets, which he knew to

be perfectly clear; the drills were two feet distant, the sets one foot distant in each drill. He then planted on the same ground four rows with sets from curled potatoes, at equal distances; in each row were about 20 sets.

Lot 1st, The curled sets.

N ^o 1. Without manure,	N ^o 3. In soot,
2. In salt,	4. In quicklime.

Lot 2d, The clear sets.

N ^o 1. Without manure,	N ^o 3. In soot,
2. In salt,	4. In quicklime.

Those planted in salt and soot in both lots were destroyed. In Lot 1st, N^o 1. and 4. all curled. Lot 2d, N^o 1. and 4. quite clear.

This experiment was made on a supposition that the insect lodged in the set, and must be destroyed on planting. But of that he is not fully satisfied. He repeated salt, soot, and quicklime, on the branches of several curled potatoes. Salt destroyed all he touched with it. Lime and soot had, he thought, a partial effect on the plants. After some time, they appeared almost as healthy as the rest. Thus, although he had done little towards the cure, he flatters himself he has pointed out the cause, the insects on the curled plants being not only very numerous, but visible to the naked eye.

XII. This writer ascribes the cause of the disease to the frost, and bad keeping in winter and spring before setting. They are liable to be damaged by frost after they are set; but this may be prevented by covering. If it be asked, why frost did not injure them formerly? he answers, it is only the new kinds which are apt to curl. To this may be added, that less care is now taken of the seed than formerly. To prevent the latter, let them remain in the ground covered with haulm or litter till the time they are wanted for setting: and, in case no frost touches them afterwards, they will be free from the disease.

XIII. This writer says, the red potato was as generally planted as the winter white and the Lincolnshire kidney are now. The first, being a later potato, did not sprout so early as the others. The white sprout very early, and therefore should be first moved out of the place where they have been preserved in the winter. Instead of that, they are often let remain till their roots and sprouts are matted together. On separating them, these sprouts are generally rubbed off, and they are laid by till the ground is ready; during which interval they sprout a second time: but these second sprouts, being weak and languid, will shrink, sicken, and die; and the fruit at the roots will be small, hard, ill-shaped, and of a brown colour.

Now, if putting off the sprouts once or more, before the sets are put in the ground, be the cause (as he verily believes it is) of the curled disease, an easy remedy is at hand. When the potatoes intended for sets are dug up, lay them in a west aspect as dry as possible: in such a situation they will not sprout so soon. The best time for removing most sorts, is the first fine day after the 24th of February. Cut them into sets as soon as possible, and let them remain covered with dry sand till the ground is prepared, which should be a winter fallow. Lay the sets in without breaking off any of the sprouts, for the second will not

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XIV. This writer says, that last spring one of his neighbours cut and set, in the usual way of drilling, some loads of the largest potatoes he could procure; and more than half of them proved curled. Being a few sets short of the quantity wanted, he planted some very small potatoes which he had laid by for the pigs. These being fully ripe and solid, there was not a curled plant among them. He apprehends, the others being curled was owing to their not being fully ripe. A crop of potatoes, set this year in rows, on ground that had borne a crop of them last year, were mostly curled; but many plants came up from seed left in the ground last season, and there was not a curled one among them.

XV. Of late years, this writer says, great improvements have been made in setting potatoes and cutting the sets. The ground is dressed cleaner and dunged stronger. Many people, in drilling, wrap up the sets entirely in the dung; by which means, though their potatoes are larger, the disease seems to be increased. They also cut their sets out of the richest and largest potatoes, which is perhaps another cause of this evil. In cold countries, where they set their own seed, which has grown on poor land, with less dung, they have no curled plants. On the contrary, when they bought rich and large potatoes for seed, they have been curled in great quantities. He believes, the richness and largeness of the seed to be the cause of the evil; for he does not remember to have seen a curled stem which did not spring from a set of a large potato.

XVI. This writer apprehends the curled disease in potatoes to proceed from a defect in the *planta seminalis*, or seed plant; and from comparing curled ones with others, there appeared to be a want of, or inability in, the powers of expanding or unfolding the parts of the former; which from this defect, forms shrivelled, starved, curled stems. On examining some of the sets at the time of getting the crop, he found them hard and undecayed; so hard, indeed, that some of them would not be soft without long boiling. This led him to think, that some manures might have the same effect on them as tanners ooze has on leather, and so harden them, that the embryo plant could not come forth with ease; but a closer examination taught him otherwise, and that they grow equally in all manures.

Some have thought that the fermentation is occasioned by too great quantities being heaped together; but the writer has seen an instance, wherein a single potato, preserved by itself, when set, produced stems of the curled kind. He thinks the most consistent and rational opinion is, that the disease is occasioned by the potatoes being taken from the ground before the stamen, or miniature plant, is properly matured and ripened.

For let it be observed, that the potato, being a native of a warmer climate, has there more sun, and a longer continuance in the ground, than in its present exotic state, consequently it has not the same natural

causes here to mature the seed plant as in its native state. We ought, therefore, to give all the opportunities our climate will admit for nature to complete her work, and fit the stamen for the next state of vegetation, especially in those intended for seed. But if the potato be taken up before the seed-plant be fully matured, or the air and sap vessels have acquired a proper degree of firmness or hardness, it must, when thus robbed of further nutrition, shrivel up; and when the vessels, in this immature state, come to act again in the second state of vegetation, they may produce plants which are curled.

If it be asked, why are they more common now than formerly? he answers, that before the present mode of setting them took place, people covered them, while in the ground, with straw, to protect them from frost.

If it be asked, why one set produces both curled and smooth stems? he answers, we suppose every eye to contain a *planta seminalis*; that all the embryos, or seed plants, contained in one potato, are nourished by one root; and that, as in ears of corn, some of these seed plants may be nourished before others.

One of his neighbours, last year, set two rows of potatoes, which proving all curled, he did not take them up; and this year there is not a curled one among them. Such potatoes, therefore, as are designed for seed, should be preserved as long in the ground as possible.

XVII. This writer advises such sets to be planted as grow in moss land; and, he says, there will not be a single curled one the first year. This is affirmed by the inhabitants of two townships, where they grow amazing quantities. A medical gentleman sowed last year two bushels of sets from one of the above places, and had not one curled; but on sowing them again this year, he had a few.

Notwithstanding there seems to be a diversity of opinions in the above writers, occasioned by the different appearances of their crops, and the seemingly contrary effects of the means used to prevent or cure the disease, we conceive that the following general propositions may be fairly drawn from the whole. 1. That some kinds of potatoes are (*cæteris paribus*) much more liable to be affected by the disease than the rest; and that the old-red, the golden-dun, and the long-dun, are the most free from it.—2. That the disease is occasioned by one or more of the following causes, either singly or combined: 1st, By frost, either before or after the sets are planted: 2d, From planting sets out of large unripe potatoes: 3d, From planting too near the surface, and in old worn-out ground: 4th, From the first shoots of the sets being broken off before planting; by which means there is an incapacity in the *planta seminalis* to send forth others sufficiently vigorous to expand so fully as they ought.—3. That the most successful methods of preventing the disease, are cutting the sets from smooth middle-sized potatoes, that were fully ripe, and had been kept dry after they were taken out of the ground; and without rubbing off their first shoots, planting them pretty deep in fresh earth, with a mixture of quicklime, or on limestone land.

A correspondent of the Bath Society is convinced, that, whatever may be its cause, the fault itself is inherent

rent in the seed; and has communicated the following method of avoiding it: "I made a hot-bed in the following manner (which method I have used ever since): I laid horse dung, &c. (as is generally used in making hot-beds), about 18 inches thick; over which I spread a layer of fine rich mould about four or five inches thick: upon the top of this mould I laid, in different divisions, a certain number of potatoes of various sorts, some of my own growth, and others brought from different parts, and covered these lightly over with more mould; they soon came up. I then observed which was freest from the blight or curl; for if there were not more than one defective in *forty* or *fifty*, I concluded I might set of that sort with safety. This method I have now practised near twelve years, and never lost my crop, or any part thereof worth mentioning; whilst my neighbours, who followed the old method, were frequently disappointed in their crops; and to the best of my knowledge, all those of my neighbours who have of late been persuaded to take the trouble of using the same means as myself, have never failed of success to their utmost wishes in one instance; nor do I ever think it will fail, if duly attended to; the fault being some hidden cause in the seed unknown at present, and I believe incurable by any means, at least which have yet come to my knowledge. My reason for planting my hot-beds so soon is, that if the frost hinder the first experiment, or they all prove bad, I may have time to make a second or third, if necessary, with different sorts of seed, before the proper season arrives for planting in the fields and grounds appointed for the great and general crops."

In addition to the interesting information upon this subject, which has been obtained by means of these societies, various other speculations about the cause and cure of this disease have of late been introduced to the notice of the public. In particular it has been strongly urged, that the disease is almost always occasioned by insects. It is said, that on looking at the roots of such potatoes as grow up curled, it will usually be found, that the bearing plant is devoured and excavated by snails, centipedes, or beetles. Sometimes also, though more rarely, the curl is supposed to arise from the leaves themselves being infected with minute animalcula. Hence, in rich soils in the neighbourhood of cities and well-manured gardens, the potatoes are most subject to the curl, because such insects as devour the seed abound most in these soils. The insects are thought to prefer one potato to another. They will hardly touch a yam. A potato from a late part of the country, which has been hardly ripened, the vermin do not seem to like; but a potato that has been somewhat sweetened or mellowed by the frost, is supposed to be greedily devoured by them.

An ingenious notion concerning the cause of the disease has been suggested from attending to the history of the plant in this country. The potato plant was introduced into the island of Great Britain from a climate much warmer than ours, as early as the reign of Queen Elizabeth; but it is a singular circumstance, that the curled disease did not make its appearance till within less than 40 years ago. Indeed, the disease is said to have first occurred in the year 1764, in the very district of Lancashire where potatoes had been first cultivated. It is also said, that the Surinam po-

tato and some other kinds which have been more recently introduced into our climate, have never yet exhibited any symptom of the curl. It is farther said, that till within these 40 years the potato plant never brought its seeds to maturity in this country, though the roots were in full perfection; that the Surinam potato and others lately introduced do not as yet produce perfect seeds at the top of their stem; and that potatoes, which have been cultivated for a length of time in bleak and mountainous situations, are still in the same state, and do not bring their seeds to maturity. Hence it is endeavoured to be inferred, that there exists a connexion in the nature of the plant between this disease and the state of maturity to which the seed is brought. It is supposed, that the plant is unfit at once to afford mature and perfect seed at the summit of its stem, and also roots capable of propagating it in perfection. From these premises it is suggested, that, to prevent the curl, it will be necessary to procure seed potatoes from mountainous situations into which the disease has not yet come, because the plant has never produced perfect fruit at the summit of its stem; or an attempt may be made to procure more perfect seed from the ordinary kind of potatoes, by destroying the flowers, which may have the effect to prevent the plant from being exhausted by bringing to maturity both fruit at its summit and roots at its bottom. Lastly, It has been supposed, upon these principles, that the disease may be prevented by rearing potatoes from the seed produced at the summit of the stem; the mode of practising which will afterwards be explained.

In the mean time, it may be observed, that the subject has been farther discussed, in a less speculative manner, by an anonymous correspondent of the Board of Agriculture*. This gentleman does not consider the curl as a specific disease, but as an accidental debility of those plants in which it occurs; that we are not, therefore, to seek for a cure or preventive in a change of seed alone, as many have all along done, but in complete attention to all that experience shows to be necessary to an accurate culture, and to their perfect growth. In this way alone, he thinks, there is reason to expect that this very useful article of human food may be cultivated with the same success as before its dreadful enemy the curl made such havoc in our crops, as of late years it certainly has done. He describes the disease as occurring, in Mid Lothian, most frequently from the following causes: 1st, From planting potatoes on soils altogether unfit for them. Being unable to penetrate a stiff soil, potatoes require a light, pervious, or open mould. For a long period after potatoes first appeared in the country, this circumstance was carefully attended to. They were planted entirely with the spade, in the lightest spots upon every farm. Hence, the plants rose vigorous, and no curl was seen; but on farmers wishing to extend the culture of potatoes, they were tempted to plant them on every soil, without regard to its nature, or tendency to produce this crop. 2dly, Imperfect culture is described as a frequent cause of curling. A crop of potatoes is commonly strong, abundant, and free from curl, in proportion to the previous culture given to the soil, and the care taken to keep it clean after they are planted. Hence, it frequently happens, that while a farmer who cultivates this root in a negli-

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*Communications to the Board, vol. ii.

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of gent manner, and upon a great scale, by means of the plough, finds his crop deficient in consequence of this disease, his cottars and servants, to whose use he allots small portions of potato ground, which they cultivate with the spade, obtain crops free from curl, and often double in quantity to his, in proportion to the extent of ground which they occupy. 3dly, Small roots, or too small a portion cut off along with the eye that is to serve for seed, appears to be a cause of curl. In the case of grain, it seldom happens, unless in very fine seasons, that small seed produces a large crop; and it is thought that something similar may occur in the case of potatoes. As the young plant must always derive its earliest nourishment from the root, out of which it springs, before it is capable of seeking its food in the surrounding soil, those plants, whose early growth is best supported and fostered, must be expected to reach the greatest perfection. To subject these ideas to the test of experiment, 64 sets were planted; 16 of which were full grown potatoes, 16 from small roots, in which no curl appeared when in the field, 16 from roots raised from the seeds two years before, and 16 from roots of plants strongly curled. They were all planted in the same manner in a light soil, in parallel furrows, with a moderate quantity of dung, and covered to the depth of three inches. Of those taken from large potatoes, none were curled, and the plants were strong and healthy. Some good plants appeared in each of the other rows, but nearly a half of the whole were curled. The proportion of curled plants was rather greatest in those raised from the seed. 4thly, Sets taken from roots that have sprouted early, and from which the germs have been rubbed, are said never to fail to produce curl. 5thly, Too much, as well as too little dung, appears to have an influence in producing curl; the first probably by corrupting the germ of the young plant, the latter by not being sufficient to produce vigorous plants. Hence, attention ought to be paid to the regular spreading of dung, which ought not to be thrown about in a careless and slovenly manner, which allows some plants to have none, while others are covered with it to the depth of several inches. 6thly, Too deep, as well as too shallow planting, gives rise to the curl. To ascertain the proper depth, 12 were planted at 18 inches deep; the same number at the depth of 16 inches, and of 14, 12, 10, 8, 7, 6, 5, 4, 3, and 2 inches; and 12 were so lightly covered, that they were not, perhaps, at the depth of one inch. The sets were all from large roots, of the same crop, cut as nearly as possible of the same size. They were all planted at the same time, in the first week of April, in a light dry soil, and they all got the same quantity of dung. The plants at the depth of 1 and 2 inches appeared first; but they were weak, and some of them curled. Those at 3, 4, and 5 inches, were all strong, and free from curl. At 6 and 7 inches, they were also healthy, and free from curl, but they were three weeks later in getting above the ground than those that were thinly covered, and the plants were neither so strong, nor the roots so large. Those planted at the depth of 8 inches rose still later, and were all weak.—Nine out of the 12 were curled. Of those planted at 10 inches deep, only four appeared; and they were so weak, that they soon withered and died. Of those deeper planted, none ever appeared. On digging them up at

the end of two months, those at 16 and 18 inches deep were found unchanged; while some of those at the depth of 12 and 14 inches, had put forth some feeble germs not exceeding the length of an inch. Those planted at 3 and 4 inches were evidently the strongest during the whole season, and their roots largest. Hence, to procure an early, abundant, and healthy crop, 3 inches appears to be the best depth for planting potatoes. 7thly, Whatever injures the new sets or the germs afterwards may produce curl: such as the trampling of horses feet at the time of planting; their being partially covered with stones or hard clods of earth; deep harrowing, when the young shoots are advancing; and grubs, snails, or insects attacking the germs at first, or the stems afterwards. Hence, 8thly, The curl was produced to an uncommon degree upon a field of stiff land, by passing a roller over it, about a fortnight after planting. 9thly, The state of the weather when the crop is young may produce the curl. Rain alone will not do so, if it be not allowed to lodge; but a long continuance of dry weather, especially with cold winds, when the shoots first appear, is apt to produce this disease, and also hoar-frosts in this early state of the crop. Hence, it is thought that the three first weeks of April answer best for planting potatoes in the south of Scotland and north of England, as they do not, in that case, appear till the middle or end of May. From all these remarks it is concluded, that though with the best management the curl can never be completely banished from our fields, yet with due attention to the leading points above mentioned, it may be prevented from being attended with any serious mischief.

As no information upon this interesting subject ought to be overlooked, we think it necessary to state, that the following plan for preventing the curl in potatoes has very recently been laid before the public, by an anonymous correspondent of the publishers of the Farmer's Magazine, who asserts, that he has adopted it with complete success. It consists of using for seed what are called *potato beans*. These beans are a dark brown excrescence, larger than a horse bean, which grows near the ground, on the haulm or shaw, generally, it is supposed, where it has been broken or wounded. They are shaped like potatoes, and have a number of eyes, from one of which grow two small leaves. It is said, that eight or ten years ago, several of these potato beans were planted merely to try if they would grow, and that they produced a great number of common sized potatoes, but of a bad quality. These potatoes, however, being cut and planted next year, produced potatoes of an excellent quality, and in great plenty. Since that time a number of beans have always been planted sufficient to produce enough of potatoes for next year's seed. They are planted at the same distance, and treated in every respect in the same manner with common sets; and their produce is equally plentiful. No other change of seed has ever been necessary.

SECT. VIII. Of the Obstacles to Agricultural Improvement.

BEFORE proceeding to the practical part of the subject, it may be proper to take notice of some of the moral and political circumstances which resist the progress of agricultural improvement.

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Obstacles to Agriculture. progress of the art of agriculture, and which ought not to be overlooked by persons engaged, or who have an intention to engage in it.

One of the first and most obvious obstacles to the improvement of this or of any other art, consists of the ignorance of its practitioners, or of its being carried on by persons of an illiterate and unintelligent character, who are unable to take a comprehensive view of the principles of their profession, or who have not sufficient curiosity to inquire after the best modes of practice, or understanding to discern the value of any new practices that are explained to them. It ought never to be forgotten, that the art of the husbandman is an intricate and extensive one, and that one of the chief circumstances which has hitherto prevented its improvement has arisen, as already mentioned, from the secluded situation of persons engaged in it. They are scattered over the face of the country, instead of being collected together like other artists in towns, so as to be enabled to derive aid from each other's experience. Fortunately this difficulty is passing away, in consequence of the diffusion of agricultural knowledge, by means of the great number of publications upon that subject which are gradually introducing themselves into the remotest corners of the country. Persons receiving a liberal education, particularly at the university of Edinburgh, have now also an easier opportunity than formerly of acquiring a knowledge of the principles of this art, in consequence of the establishment of a professorship of agriculture, which has been endowed by a private gentleman, Mr Pulteney. Even with all these advantages, however, aided as they are by the exertions of the Board of Agriculture, it can never be expected that this art can reach its ultimate degree of perfection, unless a considerable number of the persons engaged in it are men of intelligent characters and good education, who will call in the improvements which are making in other sciences, as well as in this art, in distant countries, to the assistance of their personal experience.

A second obstacle to agricultural improvement consists of the poverty of the husbandman, or of his want of capital, to enable him fully and completely to labour the soil, and provide materials for its amelioration. Complaints have often been made, with little reason, of the obstinacy of farmers, and of the tenacious manner in which they adhere to old practices, though demonstrated to be improper: But a poor man cannot afford to make experiments, or to hazard the loss of a crop for the chance of obtaining a more valuable one by some untried practice. In consequence of want of capital, large portions of territory remain in some parts of the country in a state of nature, and consequently unproductive, both to the occupier and to the proprietor. Both landlords and tenants, therefore, ought to know, that a man who engages in agriculture without a sufficient capital takes up a bad trade, in which something may be lost by both parties by the deterioration both of the soil and of the stock upon it, but from which neither the public nor themselves can derive profit.

A third obstacle to agricultural improvement sometimes arises from the possessor of the soil not having a sufficient interest in it. In barbarous nations, lands

are often possessed by communities as an undivided property, without any individual member having an exclusive right to a particular spot. In such cases the worst kind of agriculture must always prevail, for the same reason that public affairs are always worse managed than the affairs of private persons, who find their industry stimulated not merely by a sense of duty, but by the influence of avarice, and of all the other selfish passions. Considerable portions of territory in England still remain withheld from the exertions of an improving agriculture by this state of property. But, even where the interest which the cultivator has in the soil is exclusive, it may still be too limited. Where a landlord is prevented by an entail, or other family settlement, or by narrow prejudices and a short-sighted policy, from granting leases of a proper endurance, it is never likely that the soil can be well cultivated. Every outgoing farmer will endeavour, during the last years of his lease, to do as little for the land as possible, and to take from it all that he can possibly obtain. The first years of every new lease will therefore be spent by every new farmer in repairing the damage done by his predecessor. Scarcely, however, has he accomplished this object, when he himself, if his lease be short, must set about procuring indemnity for the money he has laid out in ameliorating the soil, by scourging it in his turn, or by taking from it as heavy crops as possible, and by bestowing upon it little or no expence.

Under the same head of a want of proper interest in the soil, may be enumerated the payment of tithes, of which in England every farmer so grievously complains. Whatever money the husbandman may there lay out in improvements, is not expended for himself; as the proprietor of the tithes is entitled to draw a share of the whole additional increase, and thus becomes a partner in the profits of the enterprise, without running any risk of loss by its failure. The odium of this tax, is said to induce great numbers of husbandmen to continue their lands in pasturage, to the no small detriment of the public, from the comparative unproductiveness of human food, which attends that mode of occupying the soil. Fortunately, in Scotland this evil hath been removed by the wisdom of our forefathers, as every landlord possesses the privilege of obtaining his tithes to be fixed at a settled rate of payment for ever; and, in many cases, of having his lands altogether disburdened, upon payment of a very moderate price.

The progress of the art of agriculture in Europe was long retarded by the want of respectability which attended it, when engaged in as a profession or trade from which profit was to be derived. In the feudal times, the military profession was the only employment in which a layman of liberal education could respectably engage. Agriculture, the only art which is absolutely necessary to the existence of man, was regarded with contempt, and left in the hands of the meanest of the people. Even the most ordinary mechanics were considered as superior to persons whose employment it was; because the mechanic, residing in a town, and usually under the protection of the prince, was safe from the dominion and the insults of the petty chieftains that ruled in every part of the open country. The state of affairs is now greatly altered in this respect: More enlightened views, and a better state of society,

Obstacles to Agriculture.

Obstacles
to Agricul-
ture.

have restored to the profession of agriculture the respectability which naturally belongs to it. It must be acknowledged, however, that the recent improvements which have taken place in the art, have contributed not a little to this change in the sentiments of mankind concerning the persons occupied in it. It is now found, that a man may become rich by agriculture, and that there are few better ways in which a prudent and industrious man can lay out a moderate capital. In a commercial age, the path that leads to wealth is always respected and accounted honourable, and accordingly it is now not unusual for the sons of British noblemen and gentlemen, of extensive fortunes, to become apprentices to farmers.

The last obstacle to agricultural improvements, of which we shall take notice, arises in some countries from the want of judicious legislation, or proper arrangements made by the public in its favour. The produce of the art of the husbandman, and the manures of which his lands have occasion, are all bulky commodities,

which cannot be transported without labour and expence. Unless care is taken, therefore, to prepare and maintain good roads throughout the country, the profits of agriculture must always be subjected to such deductions as will greatly retard its prosperity. In the same manner, if the state, from any narrow policy, shall prevent the husbandman from bringing his goods to the best market, by exportation or otherwise, it is impossible that his art can flourish. In former times, nations were afraid to permit the exportation of grain, even in seasons of plenty, lest they should be left without food, not considering that the surest mode of producing abundance of any commodity consists in offering, at all times, a good price for it. This error is now rectified in most nations; and at all events, in the present state of affairs, the British husbandman has no reason to complain, as the grain reared in this country is, even in the best seasons, understood to be inadequate to afford subsistence to its inhabitants.

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ture.

PRACTICE OF AGRICULTURE.

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Division of
the subject.

THE practice of agriculture naturally divides itself into three parts: 1st, The cultivation of vegetable food for men and animals; 2dly, The cultivation of vegetables, such as flax and hemp, which are more properly articles of commerce; and, 3dly, The

rearing and management of animals. To these we shall add, as connected with all the branches of agriculture, a short description of the most useful modes of fencing and enclosing lands for cattle and other objects of husbandry.

PART I. OF THE CULTIVATION OF VEGETABLE FOOD.

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Cultivation
of vegeta-
bles divided
into four
branches.

WE shall consider this branch of the subject under four divisions. In the first we shall present to the reader a statement of the most useful instruments of agriculture: 2dly, We shall state the mode of preparing land for cropping, by removing the physical obstructions to agriculture, and reducing the soil into a proper state: 3dly, We shall explain the culture of particular plants, and the practices of husbandry connected with it; and, lastly, We shall state the principles and operations of the horsehoeing or drill husbandry.

SECT. I. *Instruments of Husbandry.*

THE instruments employed in agriculture are various; as the plough, the harrow, the roller, &c. which are again diversified by various constructions adapted to particular uses.

I. OF PLOUGHS.

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The plough

The plough is a machine for turning up the soil by the action of cattle, contrived to save the time, labour, and expence, which, without this instrument, must have been employed in digging the ground, and fitting it to receive all sorts of seed.

Amidst all the varieties which can occur in the manner of ploughing the ground, arising from difference of soil, local habits, and other causes, there is still a sameness in the task, which gives a certain uniformity to the chief parts of the instrument, and should therefore furnish principles for its construction. There is not, perhaps, any invention of man that more highly merits our utmost endeavours to bring it to perfection; but it has

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an instru-
ment of the
greatest
value,

been too much neglected by those persons who study machinics, and has been considered as a rude tool, unworthy of their attention. Any thing appears to them sufficient for the clumsy task of turning up the ground; and they cannot imagine that there can be any nicety in a business which is successfully performed by the ignorant peasant. Others acknowledge the value of the machine, and the difficulty of the subject; but they think that difficulty insuperable, because the operation is so complicated, and the resistances to be overcome so uncertain, or so little understood, that we cannot discover any unequivocal principle, and must look for improvement only from experience or chance.

But these opinions are ill founded. The difficulty is indeed great, and it is neither from the ignorant farmer nor the rude artist that we can expect improvement. It requires the serious consideration of the most accomplished mechanician; but from him we may expect improvement. We have many data; we know pretty distinctly what preparation will fit the ground and may improved for being the proper receptacle for the seed, and for supporting and nourishing the plants; and though it is, perhaps, impossible to bring it into this state by the operation of any instrument of the plough kind, we know that some ploughs prodigiously excel others in reducing the stiff ground to that uniform crumbling state in which it can be left by the spade. The imperfections of their performance, or what yet remains to be done to bring the ground into this state, is directly understood. It seems, then, a determinate problem (to use the language of mathematicians), because the operation depends on the invariable laws of mechanical nature.

It

It will therefore be very proper, under this article, to ascertain, if possible, what a plough in general ought to be, by describing distinctly its task. This will surely point out a general form, the chief features of which must be found under every variety that can arise from particular circumstances.

The plough performs its task, not by digging, but by being pulled along. We do not aim at immediately reducing the ground to that friable and uniform state into which we can bring it by the spade; but we wish to bring it into such a state that the ordinary operations of the season will complete the task.

For this purpose, a slice or sod must be cut off from the firm land. This must be shoved to one side, that the plough and the ploughman may proceed in their labour; and the sod must be turned over, so that the grass and stubble may be buried and rot, and that fresh soil may be brought to the surface; and all must be left in such a loose and open condition, that it may quickly crumble down by the influence of the weather, without baking into lumps, or retaining water. The first office is performed by the coulter, which makes a perpendicular cut in the ground. The point of the sock follows this, and its edge gets under the sod, and lifts it up. While lifting it up, it also heels it over, away from the firm land. The mouldboard comes last, and pushes it aside, and gradually turns it over as far as is required.

The general form of the body of a plough is that of a wedge, or very blunt chisel, AFEDBC, (fig. 1.), having the lower corner D of its edge considerably more advanced than the upper corner B; the edge BD and the whole back AFDB is the same perpendicular plane; the bottom FDB approaches to a triangular form, acute at D, and square at F; the surface BCED is of a complicated shape, generally hollow, because the angle ABC is always greater than FDE: this consequence will be easily seen by the mathematician. The back is usually called the LAND SIDE by the ploughman, and the base FDE is called the SOLE, and FE the HEEL, and BCED the MOULDBOARD. Lastly, The angle AFE is generally square, or a right angle, so that the sole has level both as to length and breadth.

By comparing this form with attention, the reader will perceive that if this wedge is pulled or pushed along in the direction FD, keeping the edge BD always in the perpendicular cut which has been previously made by the coulter, the point D will both raise the earth and shove it to one side and twist it over; and, when the point has advanced from F to D, the sod, which formerly rested on the triangle DFE, will be forced up along the surface BCED, the line DF rising into the position Df, and the line EF into the position Ef.—Had the bottom of this furrow been covered with a bit of cloth, this cloth would be lying on the mouldboard, in the position DfE: the slice, thus deranged from its former situation, will have a shape something like that represented in fig. 2.

In as much as the wedge raises the earth, the earth presses down the wedge; and as the wedge pushes the earth to the right hand, the earth presses the wedge to the left; and in this manner the plough is strongly pressed, both to the bottom of the furrow by its sole, and also to the firm land by its back or land side. In

short, it is strongly squeezed into the angle formed along the line FD (fig. 1.) by the perpendicular plane *ab* DF and the horizontal plane FDE; and in this manner the furrow becomes a firm groove, directing the motion of the plough, and giving it a resisting support, by which it can perform all parts of its task. We beg our readers to keep this circumstance constantly in mind. It evidently suggests a fundamental maxim in the construction, namely, to make the land side of the plough an exact plane, and to make the sole, if not plane, at least straight from point to heel. Any projection would tear up the supporting plane, destroy the directing groove, and expend force in doing mischief.

This wedge is seldom made of one piece. To give it the necessary width for removing the earth would require a huge block of timber. It is therefore usually framed of several pieces, which we shall only mention in order to have the language of the art. Fig. 3. represents the land side of a plough, such as are made by James Small at Rosebank, near Ford, Mid Lothian. The base of it, CM, is a piece of hard wood, pointed before at C to receive a hollow shoeing of iron CO, called the SOCK, and tapering a little towards the hinder end, M, called the HEEL. This piece is called the HEAD of the plough. Into its fore part, just behind the sock, is mortised a sloping post, AL, called the SHEATH, the front of which is worked sharp, forming the edge of the wedge. Nearer the heel there is mortised another piece, PQ, sloping far back, called the STILT, serving for a handle to the ploughman. The upper end of the sheath is mortised into the long BEAM RH, which projects forward, almost horizontally, and is mortised behind into the stilt. To the fore end of the beam are the cattle attached. The whole of this side of the wedge is fashioned into one plain surface, and the intervals between the pieces are filled up with boards, and commonly covered with iron plates. The COULTER, WFE, is firmly fixed by its shank, W, into the beam, rakes forward at an angle of 45° with the horizon, and has its point E about six inches before the point of the sock. It is brought into the same vertical plane with the land side of the plough, by giving it a knee outward immediately below the beam, and then kneeling it again downward. It is further supported on this side by an iron stay FH, which turns on a pin at F, passes through an eye-bolt I on the side of the beam, and has a nut screwed on it immediately above. When screwed to its proper slope, it is firmly wedged behind and before the shank.—Fig. 3. N^o 2. represents the same plough viewed from above. ST is the right-hand or small stilt fixed to the inside of the mouldboard LV.

Fig. 4. represents the bottom of the wedge. CM is the head, covered at the point by the sock. Just behind the sock there is mortised into the side of the head a smaller piece DE, called the wrest, making an angle of 16° with the land side of the head, and its outside edge is in the same straight line with the side of the sock. From the point to the heel of the head is about 33 inches, and the extreme breadth of the heel is about nine. The side of the wedge, called the furrow side, is formed by the mouldboard, which is either made of a block or plank of wood, or of a thick iron plate.

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of
Husbandry.

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A funda-
mental
maxim in
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struction of
a plough.

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The several
parts of the
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Instruments
of
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120
Socks.

The sock drawn in this figure is called a SPEAR SOCK, and is chiefly used in coarse or stony ground, which requires great force to break it up. Another form of the sock is represented in the next figure 4. N^o 2. This is called a FEATHER SOCK, and has a cutting edge CF on its furrow side, extending back about ten inches, and to the right hand or furrow side about six. The use of this is to cut the sod below, and detach it from the ground, as the coulter detaches it from the unploughed land. This is of great use when the ground is bound together by knotted roots, but it is evident that it cannot be used to advantage in very stony ground. It may reasonably be asked, why the feather is not much broader, so as to cut the whole breadth of the furrow? This is sometimes done. But we must recollect that the sod is not only to be pushed aside, but also to be turned over. If it were completely detached by the feather, and chanced at any time to break on the back of the sock, it would only be pushed aside; but by leaving a little of the sod uncut, it is held fast below while it is shoved aside above, which cannot fail to twist it round. As the wrest advances, it easily destroys the remaining connection, which in general is very slight and crumbling.

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Proper
breadth of
the sole.

The breadth of the sole at the heel determines the width of the furrow. Nine inches will give enough of room for a horse or man to walk in. A greater breadth is of no use, and it expends force in pushing the earth aside. It is a mistake to suppose that a broad sole gives more room for the turned slice to stand on; for whatever is the breadth of the furrow, the successive slices will be left at their former distances, because each is shoved aside at the same distance. When the breadth of a slice exceeds its depth, and it is turned on its side, it will now stand on a narrow base, but higher than before, and therefore will stand looser, which the farmers desire. On the other hand, when the depth considerably exceeds the breadth, the sods, now turned on their sides, must be squeezed home to the ploughed land, which breaks them and tosses them up, making rough work. In wet clay soil, this is also apt to knead them together. But all this is workmanship, and has no dependence on the width of the sole behind.

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It should
be level.

We have already said that the sole is generally level from right to left at the heel. This was not the case formerly, but the wrest was considerably raised behind. It resulted from this form, that the furrow was always shallower on the right side, or there was left a low ridge of unstirred earth between the furrows. This circumstance alone was a bad practice; for one great aim of ploughing is the renewal of the superficial soil. In this way of ribbing the furrows, the sod tumbles over as soon as it is pushed to the top of the rib on the right of the *wrest* made by the plough; the firmest parts of it fall undermost, and the rest crumbles above it, making the work appear neat; whereas it is extremely unequal, and what most needs the influence of the weather to crumble it down is sheltered from it. Add to these circumstances, that the hollow is a receptacle for water, with a surface which can retain it, having been

consolidated by the pressure of the plough. For all these reasons, therefore, it seems advisable to form the furrow with a flat or level bottom, and therefore to keep the heel of the wrest as low as the heel of the head. For the same reason it is proper to hold the plough with the land side perpendicular, and not to heel it over to that side, as is frequently done, producing the same ribbed furrow as an ill-formed sole.

There is great variety of opinions about the length of the plough. If considered merely as a pointed instrument, or even as a cutting instrument acting obliquely on a given length of sod, there can be no doubt but that it will be more powerful as it is longer: that is, it will require less force to pull it through the ground. But it must also shove the earth aside, and if we double its length we cause it to act on twice as much earth at once; for when the plough has entered as far as the heel, the whole furrow side is acting together in pushing the earth to the side. Now it is found, that the force necessary for pushing a mass of earth horizontally along the rough ground is nearly equal to its weight. It would seem, therefore, that nothing is to be gained by making the base of the plough of a great length, except a greater facility in making the first penetration, and this is chiefly performed by the coulter and sock; and a great length renders the plough heavy and cumbersome; and, by causing it to act long on the sod, tends to knead and cake it.

Nothing very precise can be offered on this subject. Some sensible advantage is derived by making the plough taper, especially forward, where it acts as a boring and cutting instrument; and for this purpose it is convenient to give the coulter a slope of 45 degrees. (This has also the advantage of throwing up the stones and roots, which it would otherwise drive before it through the firm ground.) And for the same reason the edge of the feather has a great slope, it being 10 inches long and only six inches broad. But if we pursue this advantage too far, we expose ourselves to another risk. It is sometimes necessary to heel over the plough to the right, in order to get over some obstruction. In doing this, the coulter is necessarily raised for a moment, and the slanting cut now made by the feather becomes the directing groove for the plough. When the feather has a very long slope, this groove has force enough to guide the whole plough; and it is almost impossible for the ploughman to prevent it from running out of the ground to the land side (A). The feather, therefore, should not exceed ten or twelve inches in length.

But to return to the length of the plough, from which this observation has diverted us a little, we must add, that a long plough has a great advantage in the steadiness of its motion, having a much more extensive support both on the land side and below, and being therefore less affected by its inequalities. Accordingly, they are now made considerably longer than formerly; and 33 inches has been assumed as a proportion to 9 inches in breadth, in conformity to the most approved ploughs now in use.

We

(A) This is often felt with the excellent plough described by Mr Arbuthnot of Surry, in the Transactions of the Society for the Encouragement of Arts, &c. London.

ments of husbandry. We come now to treat of the mouldboard. This is the most delicate part of the plough, and is to be seen in the greatest variety in the works of different artists, each of whom has a nostrum of great value in his own opinion. It is here indeed that the chief resistances are exerted and must be overcome; and a judicious form of this part of the plough may diminish them considerably, while it performs the work in the best manner. Without pretending to say that the different resistances are susceptible of an accurate determination, we can still draw sufficient information from palpable rules of mechanics to direct us to what would be nearly the best possible form for a mouldboard. The task to be performed is to raise, push aside, and turn over to a certain degree, a slice already cut off from the firm ground. As we cannot provide for every inequality of the cohesion or tenacity of the earth, our safest way is to consider it as uniform: the weight of it is always so. As we cannot provide for every proportion between the tenacity and the weight, we must take an average or medium proportion which is not far from that of equality. Conceiving the slice at first as only tenacious, and without weight, it is an easy problem to determine the form which shall give it the intended twist and removal with the smallest force. In like manner we can proceed with a slice that has weight without tenacity. It is equally easy to combine both in any proportion; and it is easiest of all to make this combination on the supposition of equality of weight and cohesion. Supposing the slice like a brick, we know that it requires the greatest force to *begin* to raise it on one edge, and that the strain becomes less as it rises, till its centre of gravity is perpendicularly above the supporting angle. It requires no force to raise it further; for on pushing it beyond this position, it would fall over of itself, unless withheld by the tenacity of what is not yet raised. But on considering the form or plan of the sock, we find that while the weight of the sod resists most strongly, there is less of it in this situation actually rising, and this nearly in the same proportion with the labour of raising it; and we see that after the sod has attained that position in which it is ready to fall over, it has reached the wider part of the wrest, and is now pushed aside, which requires nearly the same force as to raise it: and this continues to the end of the operation.

When we take all these circumstances into consideration, it appears probable that the compound resistance does not change much from first to last. If this be really the case, it is an undoubted maxim that the whole operation should proceed equably: if it does not, there must be some part of the sod that makes a resistance greater than the medium; and as the resistances in all this class of motions increase nearly as the squares of the velocities with which they are overcome, it is demonstrable that we shall lose power if we render them unequal.

Hence we deduce this maxim, *That as the plough advances through equal spaces, the twist and the lateral sliding of the sod should increase by equal degrees.* And this determines *a priori* the form of the mouldboard. This principle occurred to Mr James Small, a ploughmaker in Berwickshire, and he published a treatise on the subject in 1784. He has given several methods for constructing mouldboards, which he supposes are in conformity to his principle; but being merely a

country artist, and unacquainted with science, his rules do not produce mouldboards having this property of equable operation, although they do not deviate far from it. His book is a very useful and instructive performance, and level to the capacity of those for whom it is intended; and we have here availed ourselves of the author's information on many points.

The high character which Small's ploughs have maintained for 25 years is a strong argument for the truth of the maxim. We shall therefore give such instructions as will enable any intelligent workman to construct such a mouldboard without any risk of failure; and if future theory or experience should discover any error in the principles from which this maxim is deduced, by showing that either the weight, the tenacity, or the lateral resistance, is exerted according to a different law from what has been assumed, the directions to be given are of such a nature that they adapt themselves with precision to these changes of principle, and will still produce a perfect and efficacious plough. Our readers will readily acknowledge that this is gaining a great point; because at present the instrument is constructed very much at random, and by a guess of the eye.

Let us now return to the wedge formerly made use of for illustrating the action of the plough. Suppose it placed in a furrow already ploughed, and that the space before the line FE (fig. 1), which is square from the line of motion FD, is covered with a piece of cloth or carpet, and that the point of the wedge enters upon it at F, and advances to D. It will evidently raise the cloth, which will now cover the side of the wedge, forming the triangle fDE. The line fD is what formerly lay in the angle along the line FD, and fE formerly lay on FE. It is this line FE therefore that we are to raise, shove aside, and twist round, by equal degrees, while the plough advances through equal spaces.

Now, if the length DF of the plough-wedge, reckoned from the point of the sock to the heel, be 33 inches, and the breadth FE behind be nine inches, the angle DEF or DEf will be nearly 74°. The construction of the furrow side of the plough is therefore reduced to this very simple problem, "To make the angle DEf turn equably round the axis DE, while the angular point L advances equably from D to E."

This will be done by means of the following very simple tool or instrument. Let IHFK (fig. 5.) be a piece of hard wood, such as oak, a foot long, three inches broad, and an inch thick. Plant on this another piece BHFC of the same breadth, four inches long, and half an inch thick. This will leave beyond it a flat 8 inches long. We shall call this the *stock* of the instrument. Let ABC be a piece of clean oak, half an inch thick, 20 inches long, and three inches broad at the end BC. Let this be fashioned like the style of a sundial, having its angle ABC 74°. Let it have a part BCE square, to the extent of four inches from C, and the rest EA worked into the form of a straight slender rod. Let EFG be a semicircle of clean plane tree or of metal, four inches radius: fasten this by small screws to the square part of the stile CE, so that its centre may be at C. Let this semicircle be divided into 180 degrees, and numbered from G along the arch GFE, so that 0° may be at G, and 180° at E. Let this stile

and

Instruments of Husbandry. and semicircle turn round the line BC by means of small hinges. This instrument may be called the mouldboard gage, or protractor. When the stile is folded down on the stock BIK, the point G will be at F; and when it is raised up to any angle, the degrees will be pointed out on the semicircle by the straight edge CF.

Nothing can be more obvious than the manner of employing this instrument once we have determined the most proper position for the sod when the work is completed. Now it seems to be the opinion of the most intelligent farmers, that the best position of the sod is that represented in fig. 6.

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Proper position of the sod.

Fig. 6. represents a section of the ground and the working parts of the plough, as viewed by a person standing straight before it. ABDC is the unploughed ground, and WB the coulter, kneed in Small's manner. FGKB is the section of the plough (or rather of the whole space through which the plough has passed, for no part of the plough has this section). HOFE is the section of a slice, pushed aside and turned over, so as to lean on the next. HE is that side of the slice which formerly lay on KB. EF is the side cut off by the coulter; and FO is the upper or grassy side. The lower corners are supposed to be a little bruised inwards, as must generally happen.

The sod is pushed 9 inches to the right hand, and it leans with its grassy side on the preceding furrow, in an angle of about 50 degrees. In this position the grass is turned down so as to rot; and there is a hollow left below to allow the rain water to run freely off, and to receive the earth as it crumbles down by the weather: and if the harrow is dragged across these ridges, it distributes along the surface the mould which was formerly at the bottom. The sod has got a twist of 130 degrees; but it is evident, that after it has been turned 90 degrees, or even a little before this, it is ready to fall over of itself. It is sufficient therefore that it be turned 90 degrees when the heel of the wrest has reached it, and the remainder of the twist is given to it by the wing or flap of the mouldboard. This, then, dictates to us the manner of applying the instrument.

Divide the edge DE (fig. 7.) of the wrest, or of a lath nailed on it, into 90 equal parts, and continue the divisions backwards to G in the same line to 130. Number the divisions backwards from the point of the sock; then place the protractor on the edge of the wrest, with the point B of fig. 5. at the 90th division (fig. 7.); that is, just at the heel, with the stock under the wrest, and the stile raised to 90°, and press it home to the joint, so that the stock may be square to the edge, and then the stile will be in the position suiting that part of the mouldboard. In like manner slide the stock forward to the 80th division, and lower the stile to 80°, and it will have the position that suits that part of the mouldboard. In the same way slide it forward to 70, 60, 50, &c. and lower the stile to 70°, 60°, 50°, &c. and we shall have the position for these several parts of the mouldboard; and thus it may be formed to the very point of the sock, because the straight edge of the wrest may be continued so far. A block of wood may be hewed to fit these several positions of the protractor stile; and this, when placed with its straight edge on the outer line of the wrest, and cut away behind in the land side plane, will be the exact shape of the plough-

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How to form the mould-board.

wedge. It would rise up indeed into a tall piece of singular shape, gradually tapering down to the point of the sock; but when cut off parallel to the ground, at the height of about 12 inches, it will form the mouldboard, the front or edge of the sheath, and the whole back of the sock except the feather, which is an extraneous piece. The wing or flap of the mouldboard is formed in the same manner, by sliding the stock of the protractor to 100, 110, 120, 130, and opening the stile to 100°, 110°, 120°, 130°. This will extend the top of the mouldboard to about 22 or 23 inches; but the lower part of the wing must be cut away, because it would push the sod too far aside after it has got the proper twist. The form of this part should be such as would exactly apply itself to a plank set at the heel of the wrest, parallel to the land-side of the head, and leaning outward 40 degrees. This will be very nearly the case, if it be made a sweep similar to the edge of the sheath. Fig. 8. is a resemblance of the surface of the mouldboard; AD being the edge of the sheath, E the heel of the wrest, and EBC the wing or flap. When cut through in a perpendicular direction, the section is hollow; if cut horizontally it is convex; and if in the direction CE, making an angle of 74° with F.D, it is straight. If the protractor be set on it at D, and gradually slidden backwards, the mouldboard will gradually open the stile, and the stile will skim its whole surface without any vacuity between them.

This form is given to the mouldboard on the authority of the supposition that the sum of the resistances arising from weight and tenacity remain pretty constant in its whole length. This cannot be affirmed with confidence in any case, and is by no means true in all. In stiff clay soils the effects of tenacity prevail, and in light or crumbling soils the weight is the chief resistance. The advantage of this mode of construction is, that it can be adapted to any soil. If the difficulty of cutting and raising the sod is much greater than that of shoving it aside and turning it over, we have only to make the rise and twist more gentle towards the point of the sock, and more rapid as we advance; and it is easy to do this according to any law of acceleration that we please. Thus, instead of dividing the edge of the wrest DE (fig. 9.) continued to G into 130 parts, draw a line Gg perpendicular to it, and draw some curve line Dg convex towards DG, and divide this into equal parts in the points 10, 20, 30, 40, &c.; and then draw perpendiculars to the wrest edge, cutting it at 10, 20, 30, 40, &c. and apply the protractor to these points. It is evident that the divisions of the wrest line are bigger at D, and grow gradually less towards G; and therefore, because each has 10° more twist than the preceding, the twist will be more rapid as it approaches the end of the mouldboard. This curve may be chosen so as to produce any law of acceleration. On the contrary, we produce a retarded or diminished twist by making the curve concave towards DG, as represented by the dotted curve.

The mathematical reader will observe, that this construction aims at regulating the twist round the line of the wrest ED. This does not produce precisely the same regulation round the line FD, which is the line of the plough's motion, and of the sod's position before it is ploughed over. The difference, however, is not worth attending to in a matter so little susceptible of precision.

struments of husbandry. But the twist round the line FD may be regulated according to any law by this instrument with equal facility. Instead of placing the stock of the protractor square with the edge of the wrest, it may be placed square with the land side of the plough. To do this, draw a line BL (fig. 5. No 2.) across the stock from the point B, making the angle LBC 16° , and put a brass pin at L, making a hole in the stile that it may not be prevented from the folding down. Then, in using the instrument, let the points B and L rest against the edge of the wrest, and proceed as directed.

A still greater variety of forms, and accommodation to particular views, with the same general dependence on principle, will be procured by giving the rod BA a motion round B in the plane of the stile, so as to form a stile of a variable angle.

A tool may even be constructed in which the rod BA might be a cutting knife: and the whole may be led along by a screw, while this knife turns round according to any law, and would gradually pare away the mouldboard to the proper form.

Thus have we reduced the fashioning the operative part of the plough to a rule which is certain. We do not mean by this, that a mouldboard made according to the maxim now given will make the best possible plough; but we have given a rule by which this part of the plough can be made unequivocally of a certain quality by every workman, whatever this quality may be, and this without being obliged to copy. No description of any curve mouldboard to be met with in books has this advantage; and we say that this rule is capable of any systematic variation, either with respect to the width of furrow, or the quantity or variation of its twist. We have therefore put it in the power of any intelligent person to make such gradual and progressive changes as may serve to bring this most useful of all instruments to perfection. The angle of the head and wrest, and the curve for dividing the wrest-line, can always be expressed in writing, and the improvements communicated to the public at large.

After this description of the working parts of a plough, and directions for giving it the most effective form, it will not be improper to consider a little its mode of action, with the view of attaining a more distinct conception of what is done by the ploughman and the cattle, and to direct him in his procedure.

Returning again to the wedge (fig. 1.), we see that it is pressed down at the point D, and as far back along the mouldboard as its surface continues to look upward, that is, all the way to the heel of the wrest. Behind this, the perpendicular sections of the mouldboard overhang, and look downward; and here, while pressing down the sod, the plough is pressed upwards. These two pressures tend to twist the plough round a transverse line somewhere between the heel and the point. The plough therefore tends to rise at the heel, and to run its point deeper into the ground. Upon the whole, the pressure downwards is much greater than the upward pressure. It is exerted over a much greater space, and is greater in most parts of that space. Behind, very little downward pressure is necessary, the sod being ready to fall down of itself, and only requiring a gentle touch to lay it in a proper position.

In like manner the plough is pressed backward by

the resistance made to the coulter and sock, and part of the resistance made to the sloping side of the mouldboard: and it is pressed to the left by the other part of the pressure on the sock and mouldboard. Instruments of Husbandry.

All these pressures must be balanced by the joint action of the cattle, the resistance of the bottom, and the resistance of the firm ground on the left-hand or land-side.

It is the action of the cattle, exerted on that point to which they are attached, which produces all these pressures. It is demonstrated by the principles of mechanics, that this force must not only be equal to the mean or compound force of these resisting pressures, but must also be in the opposite direction.

It is further demonstrated, that if a body be dragged through any resisting substance by a force acting on any point G, and in any direction whatever GH, and really moves uniformly in that direction, the force exerted exactly balances the resistances which it excites, both as to quantity and direction: And if the body advances without turning round the point by which it is dragged, the resistances on one side of this point are in equilibrium with those on the opposite side.

And, lastly, it is demonstrated, that when this equilibrium is obtained, it is indifferent to what point in the line GH the force is applied. Therefore, in fig. 3. No 1. the force acting in the direction HO may either be applied to the point of the beam H, or to the point N of the coulter, or to the point O of the sock.

When therefore a plough advances steadily, requiring no effort of the ploughman to direct it, if the line of draught OM (fig. 10.) be produced backwards to the point G of the mouldboard, that point is the place round which all the resistances balance each other. This point may be called the *centre of resistance* and the *centre of action*.

It would be of importance to determine this point by principle; but this can hardly be done with precision even in a plough of a known form; and it is impossible to do it in general for all ploughs, because it is different in each. It even varies in any plough by every variation of the proportion between the weight and the cohesion of the sod. We see how it can be found experimentally in any given uniform sod, viz. by producing backwards the line of draught. Then, if the draught rope, instead of being fixed to the muzzle of the beam, were fixed to this point, and if it were pulled in the same direction, the plough would continue to perform its work without any assistance from the ploughman, while the sod continued uniform. But the smallest inequality of sod would derange the plough so as to make it go entirely out of its path. Should the resistances between G and D prevail, the plough would go deeper, which would increase the resistances on that side where they already exceed, and the plough would run still deeper. Should the resistances behind G prevail, the heel would be pressed down, and the point would rise, which would still farther destroy the equilibrium, and, producing a greater deviation from the right path, would quickly throw the plough out of the ground.

For these reasons we must not think of attaching the draught to the centre of resistance; but must contrive a point of draught, such as shall restore the plough to its proper position when it has been driven out of it by any obstruction.

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The point
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trim.

The muzzle or end of the beam is a point which will completely suit our purpose. For suppose that the resistance on the back of the sock has prevailed, and the plough MNFD (fig. 10.) has taken the position *m n f d* represented by the dotted lines, the draught line GMO is brought down into the position *g m o*, diverging a little from GMO, and meeting the mouldboard in a point *g* considerably before G. By this means the resistances on the hinder side of *g* are increased, and those before it are diminished, and the plough quickly regains its former position.

From these observations it is plain, that whatever is the situation of the centre of resistance, the point of draught may be so chosen that the action of the cattle shall be directly opposed to the resistance of the ground, and that moreover the plough shall have no tendency either to go deeper or to run out. This is the use of the apparatus at the point of the beam, called the muzzle, represented at H (fig. 3.). It turns round a bolt *i* through the beam, and can be stopped at any height by another pin *k* put through the holes in the arch *l m*. A figure is given of the muzzle immediately below, as it appears when looking down on it. The eye to which the draught rope is hooked is spread out horizontally, as shown by HK, and has several notches O in it, to either of which the hook can be applied. This serves to counteract any occasional tendency which the plough may have to the right or left.

When the plough goes on steadily, without any effort of the ploughman, it is said to be in trim, and to swim fair; the pressure before and behind the centre of action being in equilibrium with each other. In order to learn whether a plough will be in this manner under management, hook the draught ropes as high as possible. In this state the plough should have a continual tendency to rise at the heel, and even to run a little into the ground. Then hook the rope as low as possible. The plough should now press hard on the furrow with the heel, and have some tendency to run out of the ground. If both these are observed, the plough is properly constructed in this respect; if not, it must be altered, either by changing the position of the sock or that of the beam. Lowering the end of the beam will correct the tendency of the plough to go deeper; the raising the point of the sock will also have the same effect. But it is of considerable importance not to take the point of the sock out of the plane of the sole, and it is much better to make the alteration by the beam. The slope of the coulter has a considerable effect, but it cannot be placed very far from the inclination of 45° without the risk of choking the plough by driving the roots and stones before it. It is of great consequence to have the coulter sit exactly in the direction of the plough's motion: if it is in any other direction, it will powerfully twist the plough into its own track. As it must be fixed in the middle of the beam's thickness to have strength, it is removed a little from the plane of the land side, and it was the usual practice to point it to the left below to compensate for this; but this by no means removes the disposition to twist, and it exposes to the risk of catching a stone between its point and that of the sock, which must now be driven forward through the firm ground at a great expence of labour to the cattle. Mr Small has very ingeniously remedied this by giving the coulter a short knee to the

left immediately below the beam, and thus pointing it downwards in the plumb of the land side. See fig. 6.

It is not without its use to know the absolute force necessary for tilling the ground. This has been frequently measured with a spring steelyard. One of Small's ploughs, worked by two horses, and employed in breaking up stiff land which had been ploughed before winter, and much consolidated by the rains, required a force of 360lbs. avoidupois; and we may state this as the ordinary rate of such work; but moderately firm sod, under good culture, requires at a medium 320lbs.

As we wish to embrace every opportunity of rendering this work useful to the public, we shall conclude this article with an account of a plough which has just now been recommended to public notice by the Scots Highland Society as extremely proper for a hilly country. The inventor, the Rev. Alexander Campbell minister at Kilcarnonell in Argyleshire, was honoured with the society's gold medal, value 25l.

A, the sock (fig. 11.); the land-side of which supplies the place of the coulter, and the sole of it serves for a feather; it is 18 inches long, and is made of a plate of iron 12 inches broad when finished, and somewhat under half an inch thick.—B, the head; to be made of iron in a triangular form, 4 inches broad by 2 inches at the thickest part. There are 5 inches of the head fixed in the sock.—C, the beam, 4 inches thick by 5 inches deep, gradually tapering thinner; the length 6 feet.—E, the sheath, must be of the same thickness with the beam above and the head below, and is five inches broad. An iron screw bolt connects the beam and head behind the sheath.—F, the handles are so made that the slope of the mouldboard, which is fixed to one of them, may be the longer and more gradual. They are 5 feet 8 inches long, and 2 feet 4 inches asunder at the ends.—G, the mouldboard, consists of 7 rounded sticks two inches in diameter; the covert of them is in the plane of the sole, the rest in succession close to each other above it. This makes the mouldboard 14 inches broad. To prevent any earth from getting over the mouldboard, a thin deal 4 or 5 inches broad is fixed above it. The mouldboard, land-side, and sole of the plough, are clad with iron.—The length is 20 inches: this added to 18 inches, the length of the sock, makes the length from point to heel 3 feet 2 inches.—The muzzle or bridle OPH is also of a more convenient and better construction than those commonly in use. By means of the screw pins at L and M, different degrees of land may be given to the plough; the iron rod LH being thereby moved sidewise in the socket LN, and up and down by OP. The rod is 30 inches long, one broad, and half an inch thick. It is hooked into a screwbolt at H. Two inches of the rod project at N, in the form of an eye, before the muzzle, to receive the hook of the crosstree.

The advantages of this plough are said to be: It is not so liable to be interrupted or turned out of its course by stones, roots, &c. as other ploughs are; nor does it dip so deep as to be liable to be broken by large stones or flags. The motion of the muzzle is also thought an improvement. Another advantage it has over other ploughs is, its not being so liable to be choked up by stubble, &c. This we understand to be its chief excellency, and an object much desired in

instruments of husbandry. Such are said to be the advantages of this construction; but we cannot help expressing our apprehension that the uniting the coulter and feather at the point of the sock will expose the plough to great risks of being put out of order. When the upright edge strikes a stone obliquely, especially on the land side, it must be violently twisted round the point of the head; and, having but a moderate thickness at this part, may be broken or permanently twisted. The plough will then be continually running out of its direction: and we apprehend that this defect cannot be amended without taking off the sock and putting it in the fire. When a coulter is bent by the same cause, the ploughman can either rectify it by altering the wedging, or he can straighten it in the field; and it must be observed, that the plough opposes much less resistance to the derangement of this sort of coulter than of the common one. In the common coulter the strain does not so much tend to twist the plough round the line of its motion, as to press it wholly to landward. The resistance to this is great; but a very moderate force will twist it round its line of motion. In either case, if the blow be given in that point of the coulter where the draught line crosses it, there will be no twist of the whole plough, but the point of the plough will be forced horizontally to or from the land. When the blow is out of this line, the strain tends to twist the beam or the plough. Experience will determine which of the two is the most hazardous. These ploughs were made by Thomas Lindsay, Abbeyhill, Edinburgh, and models are to be seen in the hall of the Highland Society.

A plough constructed in the following manner was formerly almost the only one used in Scotland, and is still occasionally employed where the soil is much encumbered with large stones, or the roots of shrubby plants, such as hroom, furze, &c.

The parts of which this plough is composed, are, the head, the beam, the sheath, the wrest, the mouldboard, the two handles, the two rungs, the sock, and the coulter; the two last are made of iron, and all the rest of wood.

The HEAD is designed for opening the ground below. The length of the head from A to B is about 20 inches, and the breadth from A to D above five inches; C is the point upon which the sock is driven, and the length from B to C is about six inches; *a* is the mortise into which the large handle is fixed, and *b* is the mortise into which the sheath is fixed.

The head is that part of the plough which goes in the ground; therefore the shorter and narrower it is, the friction will be the less, and the plough more easily drawn; but the longer the head is, the plough goes more steadily, and is not so easily put out of its direction by any obstructions that occur. Twenty inches is considered as a mean length; and five inches as the most convenient breadth.

The SHEATH, E, is driven into the mortise *b*, and thus fixed to the head AB. It is not perpendicular to the head, but placed obliquely, so as to make the angle formed by the lines AB and EB about 60 degrees.

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The sheath is about 13 inches long, besides what is driven into the mortise *b* (fig. 1.): about three inches broad, and one inch thick.

The sheath is fixed to the mouldboard, as in fig. 11. E, in the same manner as the wrest is fixed to the head in fig. 7.

The MOULDBOARD is designed to turn over the earth of the furrow made by the plough; and it is obvious, that, according to the position of the sheath, the mouldboard will turn over the earth of the furrow more or less suddenly. Besides, when it forms a less angle with the head than 60 degrees, the plough is in great danger of being *choked*, as the farmers term it.

The larger HANDLE, FA, is fixed to the head, by driving it into the mortise *a* (fig. 1.). It is placed in the same plane with the head; and its length from AF is about five feet four inches, and its diameter at the place where it is fixed to the beam is about two inches and a half, and tapers a little to the top F. About ten inches from A, there is a curve in the handle, which, when F is raised to its proper height, makes the lower part of it nearly parallel to the sheath EB. This curve is designed to strengthen the handle. The proper position of the handle is, when the top F is about three feet two inches higher than the bottom of the head AB.

The longer the handles, the plough is the more easily managed, because the levers are more distant from the centre of motion. The higher the top of the handles, the plough is more easily raised out of the ground, provided they be no higher than the lower part of a man's breast.

The BEAM is fixed to the larger handle and the sheath, all of which are placed in the same plane with the head. The length of it, from H to I, is about six feet; its diameter is about four inches. When the plough is in the ground, the beam should be just high enough not to be incommoded by any thing on the surface.

The position of the beam depends on the number of cattle in the plough. When two horses are yoked, the beam should be placed in such a manner as to make the perpendicular distance betwixt the bolt-hole of the beam and the plane of the head about 21 inches; when four horses are yoked, two a-breast, this distance should only be about 18 inches.

The SOCK, BP, is fixed to the end of the head, and is about two feet long. In fitting the sock to the head, the point ought to be turned a little to the land or left side; because otherwise it is apt to come out of the land altogether. When turned to the left, it likewise takes off more land; when turned upwards, the plough goes shallow; and when downwards, it goes deeper.

The COULTER is fixed to the beam, and is about two feet ten inches long, two inches and a half broad, sharp at the point and before, and thick on the back, like a knife. It is fixed and directed by wedges, so as to make the point of it equal to, or rather a little before, the point of the sock, and upon a line with the left side of the head. This oblique position enables it to throw roots, &c. out of the land, which requires less force than cutting or pushing them forward.

The WREST, BD, is fixed to the head, and is about

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26 inches long, two broad, and one thick. It is fixed to the head at B, in such a manner as to make the angle contained between the lines AB and BD about 25 degrees. The wrest is seldom or never placed in the same plane with the head, but gradually raised from the place where it is fixed to it; that is, from B to K, as in fig. 8. The position of the wrest determines the nature of the furrow. When the wrest is wide and low set, the furrow is wide; and when it is narrow and high set, the furrow is narrow.

Fig. 9. represents the two HANDLES, fixed together by the two rungs. The larger handle has already been described; the lesser one is a few inches shorter, and does not require to be quite so strong. The distance of the handles at the little rung depends on the position of the wrest. Their distance at M and P is about two feet six inches. The lesser handle is fixed to the mould-board at M, fig. 10. and to the wrest KB, at L.

Fig. 11. represents the plough complete, by joining together figures 6. and 10. in the sheath EB. The wrest BK is supposed to make an angle with the head AB as in fig. 7. and the handles joined together as in fig. 9.

After having given such a particular description of all the parts and proportions of the Scots plough, it will easily appear how it separates, raises, and turns over the earth of the furrow. If it had no coulter, the earth would open above the middle of the sock, and in a line before the sheath; but as the coulter opens the earth in a line with the left side of the head, if the soil has any cohesion, the earth of the furrow will be wholly raised from the left side, and, as the sock moves forward, will be thrown on the right side of the sheath, and by the casting out of the mouldboard, or the raising of the wrest, will be turned over.

Fig. 12.

The BRIDLE, or MUZZLE, is another article belonging to the plough. It is fixed to the end of the beam, and the cattle are yoked by it. The muzzle commonly used is a curved piece of iron, fixed to the beam by a bolt through it. ABC is the muzzle, AC the bolt by which it is fixed to the beam; D is the swingle-tree or cross-tree, to which the traces are fixed; and B is a hook or cleek, as it is commonly called, which joins the muzzle and swingle-tree.

Fig. 13.

Some use another kind of muzzle, ABCD. It is fixed to the beam by two bolts, and has notches by which the cleek of the swingle-tree may be fixed either to the right or the left of the beam. There are also different holes for the hind bolt to pass through, by which the draught may be fixed either above or below the beam. AD is the fore bolt upon which the muzzle turns; on BC are four notches, betwixt any two of which the cleek of the swingle-tree may be fixed. When the cleek is fixed at B, the plough is turned towards the firm land, and takes off a broader furrow; and when fixed at C, it is turned towards the ploughed land, and takes off a narrower furrow. E and F are the holes on each side through which the hindmost bolt passes. When the bolt is put through the highest two, these holes being thereby brought to the middle of the beam, the fore part of the muzzle is raised above the beam, and the plough is made to go deeper, and when put through the lowest two, the fore part of the muzzle is sunk below the beam, and the plough is made to go shallower. This muzzle may be so con-

structed as to have the same play with the common one. A is the end of the beam; B a plate of iron sunk into it, and, with a similar one on the other side, is rivetted into it by bolts; C is the muzzle fixed to these plates of iron by the bolt D, which bolt may be put through any of the holes EE. From the construction of this muzzle it is plain, that it has the same play with the common one, and that by it the land of the plough may be altered at pleasure.

Of all forms, that of the Scots plough is the fittest for breaking up stiff and rough land, especially where stones abound; and no less fit for strong clays hardened by drought. The length of its head gives it a firm hold of the ground; its weight prevents it from being thrown out by stones; the length of the handles gives the ploughman great command to direct its motion; and by the length of its head, and of its mouldboard, it lays the furrow-slice cleverly over. This plough was contrived during the infancy of agriculture, and was well contrived: in the soils above described it has not an equal.

But in tender soil it is improper, because it adds greatly to the expence of ploughing, without any counterbalancing benefit. The length of the head and mouldboard increases the friction, and consequently it requires a greater number of oxen or horses than are necessary in a shorter plough. There is another particular in its form that resists the draught: the mouldboard makes an angle with the sock, instead of making a line with it gently curving backward. There is an objection against it no less solid, that it does not stir the ground perfectly: the hinder part of the wrest rises a foot above the sole of the head: and the earth that lies immediately below that hinder part, is left unstirred. This is ribbing land below the surface, similar to what is done by ignorant farmers on the surface.

These defects must be submitted to in a soil that requires a strong heavy plough; but may be avoided in a cultivated soil by a plough differently constructed. Of all the ploughs fitted for a cultivated soil free of stones, that already mentioned, which was introduced into Scotland about 20 years ago, by James Small in Blackadder Mount, Berwickshire, is the best. It is now in great request; and with reason, as it avoids all the defects of the Scots plough. The shortness of its head and its mouldboard lessens the friction greatly: from the point of the sock to the back part of the head it is only 30 inches: and the whole length, from the point of the beam to the end of the handles, between eight and nine feet. The sock and mouldboard make one line gently curving; and consequently gather no earth. Instead of a wrest, the under edge of the mouldboard is one plane with the sole of the head; which makes a wide furrow, without leaving any part unstirred. It is of late commonly termed the chain plough, because it is drawn by an iron chain fixed to the back part of the beam immediately before the coulter. This has two advantages; first, by means of a muzzle, it makes the plough go deep or shallow; and, next, it stresses the beam less than if fixed to the point, and therefore a slender beam is sufficient.

As we have already sufficiently explained the speculative principles upon which this plough is formed, we shall only remark, that it is proper for loams, for carse clays,

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fig. 1.

struments of husbandry. clays, and, in general, for every sort of tender soil free of stones. It is even proper for opening up pasture ground, where the soil has been formerly well cultivated.

¹⁴¹ A spiked sock is used in the Scots plough. The difference between it and the feathered sock will be best understood by comparing their figures. Fig. 14. is the common sock, and fig. 15. the feathered one.

From the construction of the feathered sock, it is obvious, that it must meet with greater resistance than the spiked or spear sock. However, when the plough takes off the earth of the furrow broader than that part of the sock which goes upon the head, it is more easily drawn than the plough with the spiked or spear sock; for the earth which the spiked or spear sock leaves to be opened by the wrest, is more easily opened by the feather of the other sock. In ley, the feather sock makes the plough go more easily, because the roots of the grass, which go beyond the reach of the plough, are more easily cut by the feather than they can be torn asunder by the spiked or spear sock. The feathered sock is also of great use in cutting and destroying root weeds. The spiked or spear sock, however, answers much better in strong land.

It is proper here to add, that in fitting the feathered sock into the head, the point of it should be turned a little from the land, or a little to the right hand.

¹⁴² If we look back 40 years, ploughs of different constructions did not enter even into a dream. The Scots plough was universally used, and no other was known. There was no less ignorance as to the number of cattle necessary for this plough. In the south of Scotland, six oxen and two horses were universal; and in the north 10 oxen, sometimes 12. The first attempt to lessen the number of oxen was in Berwickshire. The low part of that county abounds with stone and clay marl, the most substantial of all manures, which had been long used by one or two gentlemen. About 30 years ago it acquired reputation, and spread rapidly. As two horses and two oxen were employed in every marl cart; the farmer, in summer fallowing, and in preparing land for marl, was confined to four oxen and two horses. And as that manure afforded plenty of succulent straw for oxen, the farmer was surprised to find that four oxen did better now than six formerly. Marling, however, a laborious work, proceeded slowly, till people were taught by a noted farmer in that country, what industry can perform by means of power properly applied. It was reckoned a mighty task to marl five or six acres in a year. That gentleman, by having plenty of red clover for his working cattle, accomplished the marling of 50 acres in a summer, and once of 54. Having so much occasion for oxen, he tried with success two oxen and two horses in a plough; and that practice became general in Berwickshire.

A chain-plough of a smaller size than ordinary, drawn by a single horse, is of all the most proper for horse-hoeing, supposing the land to be mellow, which it ought to be for that operation. It is sufficient for making furrows to receive the dung, for ploughing the drills after dunging, and for hoeing the crop.

A still smaller plough of the same kind may be recommended for a kitchen garden. It can be reduced to the smallest size, by being made of iron; and where

the land is properly dressed for a kitchen garden, an iron plough of the smallest size drawn by a horse will save much spade-work.

Nor is this the only case where a single-horse plough may be profitably employed. It is sufficient for seed-furrowing barley, where the land is light and well-dressed. It may be used in the second or third ploughing of fallow, to encourage annual weeds, which are destroyed in subsequent ploughings.

The *Rotheram plough* is a machine of very simple construction, and easily worked. ¹⁴⁴ AB is the beam, CD the sheath, EBD the main handle, FR the smaller handle, GH the coulter, KI the sock or share, NP the bridle, S the fly-band, and ML a piece of wood in place of a head. The whole of this plough should be made of ash or elm; the irons should be steeled and well tempered; and that part of the plough which is under ground in tilling should be covered with plates of iron. The difference between this and the common plough seems to consist in the bridle at the end of the beam, by which the ploughman can give the plough more or less land by notches at N, or make it cut deeper or shallower by the holes at P; in the coulter or share, which is so made and set as to cut off the new furrow without tearing; and in the mouldboard, which is so shaped as first to raise a little, and then gradually turn over, the new cut furrow, with very little resistance. But the greatest advantage attending it, is its being so easy of draught, that it will do double the work of any common plough.

The *paring plough* is an instrument used in several parts of England for paring off the surface of the ground, in order to its being burnt. Mr Bradley has given the following description of a very simple instrument of this kind: From A to A (fig. 15.) is the plough-beam, about seven feet long, mortised and pinned into the block B, which is of clean timber without knots. CC are the sheaths or standards, made flat on the inside, to close equally with the paring plate, and fastened to it with a bolt and key on each side, as at D. E is the paring plate of iron laid with steel about four inches wide, and from 12 to 18 inches long. This plate must be made to cut on the sides, which are bolted to the standards as well as at the bottom part. FF are two iron braces to keep the standards from giving way: these standards must be mortised near their outsides and through the block. GG are the plough handles, which must be fixed slopeways between the beam and the standards. The pin holes in the beam, the use of which is to make this plough cut more or less deep, by fixing the wheels nearer to or farther from the paring plate, should not be above two inches asunder.

Fig. 1. represents the four-coultered plough of Mr The Tull. Its beam is ten feet four inches long, whereas that of the common plough is but eight. The beam is straight only from a to b, and thence arched; so that the line let down perpendicularly from the corner at o, to the even surface on which the plough stands, would be 11½ inches; and if another line were let down from the turning of the beam at b, to the same surface, it would be one foot eight inches and a half; and a third line let down to the surface from the bottom of the beam at that part which bears upon the pillow, will

X x 2

show

instruments of Husbandry.

¹⁴⁴ Rotheram Plough, Plate IX. fig. 3.

¹⁴⁵ The Paring Plough, Plate IX. fig. 4.

¹⁴⁶ The Four-coultered Plough, Plate IX.

Instruments of Husbandry show the beam to be two feet ten inches high in that part. At the distance of three feet two inches from the end of the beam *a*, at the plough-tail, the first coulter, or that next the share, is let through; and at 13 inches from this, a second coulter is let through: a third at the same distance from that; and, finally, the fourth at the same distance from the third, that is, 13 inches, and from *a* to *b* is seven feet.

The crookedness of the upper part of the beam of this plough is contrived to avoid the too great length of the three foremost coulters, which would be too much if the beam was straight all the way; and they would be apt to bend and be displaced, unless they were very heavy and clumsy. Ash is the best wood to make the beam of, it being sufficiently strong, and yet light. The sheath in this plough is to be seven inches broad. The fixing of the share in this, as well as in the common plough, is the nicest part, and requires the utmost art of the maker; for the well-going of the plough wholly depends upon the placing this. Supposing the axis of the beam, and the left side of the share, to be both horizontal, they must never be set parallel to each other; for if they are, the tail of the share bearing against the trench as much as the point, would cause the point to incline to the right hand, and it would be carried out of the ground into the furrow. If the point of the share should be set so, that its side should make an angle on the right side of the axis of the beam, this inconvenience would be much greater; and if its point should incline much to the left, and make too large an angle on that side with the axis of the beam, the plough would run quite to the left hand; and if the holder, to prevent its running quite out of the ground, turns the upper part of his plough towards the left hand; the pin of the share will rise up, and cut the furrow diagonally, leaving it half unploughed. To avoid this and several other inconveniences, the straight side of the share must make an angle upon the left side of the beam; but that must be so very acute a one, that the tail of the share may only press less against the side of the trench than the point does. This angle is shown by the pricked lines at the bottom of fig. 9. where *ef* is supposed to be the axis of the beam let down to the surface, and *gf* parallel to the left side of the share: and it is the subtense *eg* that determines the inclination which the point of the share must have towards the left hand. This subtense, says Mr Tull, at the fore-end of an eight-foot beam, should never be more than one inch and a half, and whether the beam be long or short, the subtense must be the same.

The great thing to be taken care of, is the placing the four coulters; which must be so set, that the four imaginary places described by their four edges, as the plough moves forward, may be all parallel to each other, or very nearly so, for if any one of them should be very much inclined to, or should recede much from, either of the other, then they would not enter the ground together. In order to place them thus, the beam must be carefully pierced in a proper manner. The second coulter-hole must be two inches and a half more on the right hand than the first, the third must be as much more to the right of the second, and the fourth the same measure to the right hand of the third; and this two inches and a half must be carefully mea-

sured from the centre of one hole to the centre of the other. Each of these holes is a mortise of an inch and a quarter wide, and three inches and a half long at the top, and three inches at the bottom. The two opposite sides of this hole are parallel to the top and bottom, but the back is oblique, and determines the obliquity of the standing of the coulter, which is wedged tight up to the poll. The coulter is two feet eight inches long before it is worn: the handle takes up sixteen inches of this length, and is allowed thus long, that the coulter may be driven down as the point wears away. As to the wheels, the left hand wheel is 20 inches in diameter, and that on the right hand two feet three inches, and the distance at which they are set from each other is two feet $5\frac{1}{2}$ inches.

2. The PATENT SWORD-CUTTER.

The different parts of this instrument are represented by N^o 1. 2. 3. of fig. 6. AA, &c. a square frame three feet four inches from the fore to the hind part, by four feet three inches, the breadth of the machine within side; the timber (when of fir) four inches square, placed on two wheels BB three feet diameter, a little more or less (the old fore-wheels of a chaise may answer the purpose), to support the hind part of the machine.

CC, &c. are six strong pieces of wood, called *bulls*, three feet long, five inches and a half broad, the thickness six inches at E, and tapering to three inches at F. Into these bulls are fixed the cutting wheels, which are iron, 13 inches in diameter, $\frac{3}{4}$ ths of an inch thick at the centre, about an inch diameter, for piercing holes to fix the iron axles in; from that they are to be of such thickness, as to allow the edges to be well steeled. The wheels are fixed by two bolts going through the bulls, with eyes on one end for the axles of the wheels to run in, and nuts and screws on the other to make them very firm by being sunk in the bulls, to prevent their interfering with the weights LL, &c. resting on them.

GG, &c. are hollow pieces of wood, called *thorles*, each $3\frac{1}{2}$ inches long, which enclose the bolt MM, and keep the bulls CC, &c. at their proper distances, but may be made longer or shorter at pleasure, according as the sward requires to be cut in larger or smaller pieces. They are in two pieces bound together, and jointed by a strap of leather or cord, which allows them to be readily changed when the cutting wheels require to be kept at more or less distance.

The iron bolt MM goes through two pieces of wood or iron PP, seven inches long, clear of the wood, supported by iron stays fixed to the frame, and through all the bulls. It requires to be strong, as the draught of the horses terminates there.

HH, N^o 2. and 3. a cylinder or segment of wood, seven inches diameter, called a *rocking tree*, which goes across the frame, and moves on the pivots fixed into it, one at each end, supported by an iron bolt or piece of wood mortised into the frame, eight inches high, as appears in N^o 2. and 3. to which six chains or ropes are fixed by hooks, at different distances, as you want your cuts, nine, eight, seven, or six inches from one another, and are joined to the end of each bull in which the cutting wheels run; so that when the rocking tree is turned about by the lever I, fixed in the middle of it, all the bulls, with their cutting wheels, are

ments are raised out of the ground at once, as in N^o 3. by which means the machine may be turned, or moved from place to place with great ease, without any danger of straining the wheels.

LLL, &c. N^o 1. 2. 3. are weights of freestone, 26 inches long and six inches broad; the under one four inches thick, the upper one three inches thick; weighing about 64lb. the under, and 48 the upper; each of them having two holes, through which iron spikes, firmly fixed in the bulls, pass, in order to keep them steady.

When the ground is easily cut, the under stone may answer; when more difficult, the other stone may be added; so that every wheel may have seven stone weight upon it, which has been found sufficient for the stiffest land and toughest sward the machine has ever been tried on. Cast iron weights will answer fully better, but are more expensive.

The lever I, N^o 2. 3. which ought to be five feet long, must have a sliding rope on it, fixed to the back part of the frame; so that when the cutting wheels are all taken out of the ground three or four inches, by the rocking tree's being turned partly round by the lever, the rope may be fixed to it by a loop over the pin R, N^o 3. (it ought to be placed three feet four inches from the extremity of the lever I). Thus all the cutting wheels are kept out of the ground till the machine is turned; and then by moving the loop off the pin, it slips back towards the frame, and the lever is gently let back to its place, as in N^o 2. by which the cutting wheels are put into their former posture, by the weights fixed on the bulls in which they run. The levers may be made of good tough ash.

PP, N^o 1. a small bolt of iron, with a hook on one end of it (one is sufficient), to strengthen the bolt MM to be hooked on the centre of it, and joined to the frame by a nut and screw.

The grooves in which the cutting wheels run, may be covered below at the hinder part with a plate of thin black iron, 6 inches long, 3 inches broad, having a slit in it where the wheels run, to prevent (if found necessary) any grass, weeds, or small stones, from filling the grooves, and clogging the wheels.

To the frame N^o 1. are fixed (for a double-horse sward-cutter (three shafts, as in a waggon, of such length, strength, and distance from one another, as any workman may think proper.

For a single-horse sward-cutter (which has only four cutting wheels), a pair of shafts are used, and may make the two sides of the frame without any joinings. The width of the frame, in proportion to the double-horse sward-cutter, is as four to six.

It is recommended for a double-horse sward-cutter to have eight bulls and wheels, in order that when it is used to reduce hard clody summer-fallow, or land for barley, before the last furrow, or even after it, the whole weight (42 stone) employed in cutting the stiffest land and toughest sward, may be applied to the 8 bulls then at 6 inches from one another. The 64lb. weights to be applied to six of the bulls, and two of the 48lb. weights to each of the additional bulls, which is a sufficient weight for the purpose, and will effectually prevent a clod of more than six inches breadth from escaping being broke into pieces.

In the same manner, a single-horse sward-cutter may

have six bulls for the above-mentioned purpose; the 28 stone belonging to it divided thus: The 64lb. weights to four of the bulls, and two of the 48lb. weights to each of the additional bulls.

That the machine may come as cheap as possible to the public, the inventor is of opinion that the expence of the two wheels and the iron axle (which is considerable) may be saved, by joining strongly to the frame at S, N^o 3. a piece of wood with a little curve at the extremity of it, resembling the foot of a sledge formerly much used in Scotland to carry in the corn from the field; the part of it resting on the ground being kept 18 inches (the half diameter of the wheels) from the frame by a strong support of wood.

As the two outer bulls next the frame are apt to get under it, so as to prevent the cutting wheels from being taken out of the ground, a thin slip of iron fixed to the inside of the frame, nearly opposite to the back end of the bulls, of convenient length, will be found necessary.

The original intention of this machine was to prepare old grass ground for the plough, by cutting it across the ridges, in the beginning of or during winter, when the ground is soft, in order to answer all the purposes that Mr Tull proposed by his four-coulter plough above described, and so strongly recommended by him for bringing into tilth grass ground that has been long rested. This the sward-cutter has been found to do much more effectually and expeditiously: For Mr Tull's machine cuts the sward in the same direction with the plough; and is liable, from every obstruction any of the coulter meet with, to be thrown out of its work altogether, or the instrument broken: to which the sward-cutter, consisting of four, six or more cutting wheels, is never liable, from these being entirely independent of one another, cutting the ground across the ridges before ploughing, and rendering that operation easier to two horses than it would be to three, without its being cut. The furrow being cut across, falls finely from the plough in squares of any size required, not under six inches, in place of long slips of tough sward seldom and imperfectly broke by the four-coulter plough.

This instrument is very fit for preparing ground for burnbating, as it will save much hard labour.

It may be properly used in cross-cutting clover of one or two years standing, to prepare the ground for wheat, if the land is stiff and moist enough.

It may be applied to cutting and cross-cutting pasture ground, intended to have maaure of any kind put upon it to meliorate the grass. In this it will far exceed the scarificator mentioned in one of Mr Young's tours; as that instrument is liable, as well as the four-coulter plough, to be thrown out of its work when meeting with a stone or other interruption. This the sward-cutter is proof against, which is looked on as its greatest excellence.

In preparing for barley, the sward-cutter excels a roller of any kind in reducing the large hard clods in clay land, occasioned by a sudden drought, after its being ploughed too wet; and it is likewise very proper for reducing such clay land when under a summer-fallow. In this operation, the sward-cutter is greatly to be preferred to the cutting-roller, likewise mentioned by Mr Young in one of his tours; for the wheels.

Instruments of Husbandry. wheels of the latter being all dependent one on another, when one is thrown out by a stone, three or four must share the same fate. Besides, the cutting-roller has but seven wheels in six feet; whereas the sward-cutter has six in four feet three inches, at nine inches distant; and, if necessary, may have them so near as six inches.

After old grass ground is cut across with the sward-cutter and ploughed, it has a very uncommon and work-like appearance, from each square turned over by the plough being raised up an inch or two at the side last moved by the earthboard; so that the field when finished, is all prettily waved, and resembles a piece of water when blown on by a gentle breeze. By this means a very great deal of the land's surface is exposed to the frost and other influences of the air, which cannot fail to have a good effect on it.

Two horses are sufficient for the draught of a double-horse sward-cutter, and one horse for a single-horse one. One man manages the machine and drives the horses. He begins his operation by first measuring off 20 or 30 paces from the machine, less or more as he inclines, and there fixes a pole. He then cuts the field across, as near at right angles with the ridges as he can. When the cutting wheels are past the last furrow about a yard or so, and the machine is upon the utmost ridge of the field on which it must turn, he must stop the horses; then take hold of the lever I, N^o 2. and by pulling it to him he raises the cutting wheels out of the ground, which are kept so by the loop of the rope being put over the pin R, in the lever I, N^o 3. till the machine is turned and brought to its proper place, which is done by measuring off the same distance formerly done on the opposite side of the field. When the cutting wheels are exactly over the outmost furrow, then, on the horses being stopped, the rope is slipped off the pin R, and the lever returned to its former place, as represented N^o 2. which allows the weights LL, &c. to force the cutting wheels into the ground again. He then goes on until the interval betwixt the first and second stroke of the machine is all cut. In this manner the field is to be finished, after which you may begin to plough when you please. (N. B. There must be a pole at each side of the field.)

It is of no consequence whether the land to be sward-cut is in crooked ridges or straight, in flat ridges or in very high raised ones. Be the surface ever so uneven, the cutting wheels, being all independent of one another, are forced by their weights into every furrow or hollow.

One sward-cutter will cut as much in one day as six ploughs will plough.

The land may lie several months in winter after being sward-cut, when there is no vegetation to make the cuts grow together again before it is ploughed; but the sooner it is ploughed after cutting the better, that it may have the benefit of all the winter's frost, which makes it harrow better at the seed time.

When the ground is harrowed, the harrows ought to go with the waves which appear after ploughing, not against them, as by that means they are less apt to tear up the furrows all cut into squares. This, however, need only be attended to the two first times of harrowing, as they are called.

Any common wright and smith may make the in-

strument. It is very strong, very simple, and easily managed and moved from place to place; and, if put under cover, will last many years.

It was invented some time ago, by the Honourable Robert Sandilands; and is represented in the Plate as it has been lately improved by him, the price being at the same time reduced from 15l. or 16l. to 5l. or 6l.

3. The CULTIVATOR.

This instrument was invented by Mr William Lester of Northampton; and that gentleman received, from the Society for the encouragement of Arts, the society's silver medal. The purpose of this instrument is to pulverize tenacious soils that have been once ploughed, in a much more complete and rapid manner than can be accomplished by any other instrument. It is thus described, Plate XII.—A, the beam; BB, the handles; CC, a cross bar of a semicircular form, containing a number of holes, which allow the two bars DD to be placed nearer or further from each other.

DD are two strong bars moveable at one end upon a pivot E, and extending from thence in a triangular form to the cross bar C. In these bars are square holes, which allow the shares F placed therein to be fixed to any height required.

The seven shares marked F, are shaped at their lower extremities like small trowels; the upper parts of them are square iron bars.

G G G are three iron wheels on which the machine is moved; they may be raised or lowered at pleasure.

H, the iron hook to which the swingle-tree and horses are to be fixed.

When the machine is first employed on the land, the bars DD are expanded as much as possible. As the soil is more loosened, they are brought nearer to the centre; the shares then occupy a less space, and the soil will consequently be better pulverized.

In working on a rough fallow, therefore, the cultivator should be set for its greatest expansion, and contracted in proportion as the clods are reduced. The inventor declares himself confident that one man, a boy, and six horses, will move as much land in a day, and as effectually, as six ploughs, meaning land in a fallow state that has been previously ploughed. It is requisite in some states of the soil to alter the breadth of the shares, but of this it is presumed that every farmer will be a proper judge. By the expansion and contraction of the cultivator, the points of the shares are in a small degree moved out of the direct line; but this is said to be so trifling as to prove no impediment to its working.

A certificate from Mr William Shaw of Cottenend, near Northampton, states, that he had used Mr Lester's cultivator, upon a turnip fallow, in summer 1800; and that he believes it to be a very useful implement for cultivating the land in a fallow state, by its working or scuffling off seven acres per day with six horses. He adds, that from its property of contracting and expanding, it is calculated to work the same land in a rough or fine state, by which means it unites the principles of two implements in one, and by the index on the axis it may be worked at any depth if required.

4. The BRAKE.

The brake is a large and weighty harrow, the purpose of which is to reduce a stubborn soil, where an ordinary

ordinary harrow makes little impression. It consists of four square bulls, each side five inches, and six feet and a half in length. The teeth are 17 inches long, bending forward like a coulter. Four of them are inserted into each bull, fixed above with a screw-nut, having 12 inches free below, with a heel close to the under part of the bull, to prevent it from being pushed back by stones. The nut above makes it easy to be taken out for sharpening. This brake requires four horses or four oxen. One of a lesser size will not fully answer the purpose: one of a larger size will require six oxen; in which case the work may be performed at less expense with the plough.

This instrument may be applied to great advantage in the following circumstances. In the fallowing strong clay that requires frequent ploughings, a braking between every ploughing will pulverize the soil, and render the subsequent ploughings more easy. In the month of March or April, when strong ground is ploughed for barley, especially if bound with couch-grass, a cross-braking is preferable to a cross-ploughing, and is done at half the expence. When ground is ploughed from the state of nature, and after a competent time is cross-ploughed, the brake is applied with great success, immediately after the cross-ploughing, to reduce the whole to proper tilth.

Let it be observed, that a brake with a greater number of teeth than above mentioned, is improper for ground that is bound together by the roots of plants, which is always the case of ground new broken up from its natural state. The brake is soon choked, and can do no execution till freed from the earth it holds. A less number of teeth would be deficient in pulverizing the soil.

5. The HARROW.

Harrowes are commonly considered as of no use but to cover the seed; but they have another use, scarce less essential, which is to prepare land for the seed. This is an article of importance for producing a good crop. But how imperfectly either of these purposes is performed by the common harrow, will appear from the following account of it.

A little reflection, even without experience, will make it evident, that the same harrows, whatever be the form, can never answer all the different purposes of harrowing, nor can operate equally in all different soils, rough or smooth, firm or loose. The following, therefore, have been recommended; which are of three different forms, adapted for different purposes. They are all of the same weight, drawn each by two horses. Birch is the best wood for them, because it is cheap, and not apt to split. The first is composed of four bulls, each four feet ten inches long, three and a quarter inches broad, and three and a half deep; the interval between the bulls 11 inches and three fourths; so that the breadth of the whole harrow is four feet. The bulls are connected by four sheths, which go through each bull, and are fixed by timber nails driven through both. In each bull, five teeth are inserted, ten inches free under the bull, and ten inches asunder. They are of the same form with those of the brake, and inserted into the wood in the same manner. Each of these teeth is three pounds weight: and where the har-

row is made of birch, the weight of the whole is six stone 14 pounds Dutch. An erect bridle is fixed at a corner of the harrow, three inches high, with four notches for drawing higher or lower. To this bridle a double tree is fixed for two horses drawing abreast, as in a plough. And to strengthen the harrow, a flat rod of iron is nailed upon the harrow from corner to corner in the line of the draught.

The second harrow consists of two parts, connected together by a crank or hinge in the middle, and two chains of equal length, one at each end, which keep the two parts always parallel, and at the same distance from each other. The crank is so contrived, as to allow the two parts to ply to the ground like two unconnected harrows; but neither of them to rise above the other, more than if they were a single harrow without a joint. In a word, they may form an angle downward, but not upward. Thus they have the effect of two harrows in curved ground, and of one weighty harrow in a plain. This harrow is composed of six bulls, each four feet long, three inches broad, and three and a half deep. The interval between the bulls nine and a half inches; which makes the breadth of the whole harrow, including the length of the crank, to be five feet five inches. Each bull has five teeth, nine inches free under the wood, and ten inches asunder. The weight of each tooth is two pounds; the rest as in the former.

The third consists also of two parts, connected together like that last mentioned. It has eight bulls, each four feet long, two and a half inches broad, and three deep. The interval between the bulls is eight inches; and the breadth of the whole harrow, including the length of the crank, is six feet four inches. In each bull are inserted five teeth, seven inches free under the wood, and ten and a half inches asunder, each tooth weighing one pound. The rest as in the two former harrows.

These harrows are a considerable improvement. They ply to curved ground like two unconnected harrows; and when drawn in one plane, they are in effect one harrow of double weight, which makes the teeth pierce deep into the ground. The imperfection of common harrows, mentioned above, will suggest the advantages of the set of harrows here recommended. The first is proper for harrowing land that has long lain after ploughing, as where oats are sown on a winter furrow, and in general for harrowing stiff land: it pierces deep into the soil by its long teeth, and divides it minutely. The second is intended for covering the seed: its long teeth lays the seed deeper than the common harrow can do; which is no slight advantage. By placing the seed considerably under the surface, the young plants are, on the one hand, protected from too much heat, and, on the other, have sufficiency of moisture. At the same time, the seed is so well covered that none of it is lost. Seed slightly covered by the common harrows wants moisture, and is burnt up by the sun; beside, that a proportion of it is left upon the surface uncovered. The third harrow supplies what may be deficient in the second, by smoothing the surface, and covering the seed more accurately. The three harrows make the ground finer and finer, as heckles do lint; or, to use a different comparison, the first harrow makes the bed,

Instruments
of
Husbandry.

Properties
of these
harrows.

Instruments
of
Husbandry.

bed, the second lays the seed in it, the third smooths the clothes. They have another advantage not inferior to any mentioned: they mix manure with the soil more intimately than can be done by common harrows; and upon such intimate mixture depends greatly the effect of manure, as has already been explained. To conclude, these harrows are contrived to answer an established principle in agriculture, That fertility depends greatly on pulverizing the soil, and on an intimate mixture of manure with it, whether dung, lime, marl, or any other.

Plate VII.

The Chain and Screw harrow. Fig. 8. is the plan of a harrow also invented by Mr Sandilands, and to which he has given the name of the *chain and screw harrow*. Its properties are, that if your ridges be high, and you wish to harrow them from one end to the other, by lengthening the chain (which the screw commands), the harrow, when drawn along, forms an angle downwards, and misses none of the curve of the ridge, so far as it extends (which may be nine feet, the distance from A to B. The extent, in the contrary direction, is five feet six inches). When the crowns of the ridges have got what is thought a sufficient harrowing lengthwise, you shorten the chain by the screw, which forms an angle upwards; the harrow is then drawn by the horses, one on each side of the furrow; which completely harrows it, and the side of the ridges, if 18 feet broad.

When you want to harrow even ground or high ridges across with the screw, you can bring the harrow to be horizontal, so as to work as a solid harrow without a joint.

The teeth are formed and fixed in the common manner, square, not in the fashion of coulter; and are nine or ten inches below the wood, and of such strength as it is thought the land requires. The teeth cut, or rather tear, the ground at every four inches without variation, though seemingly placed irregularly; and this without any risk of choking, except sometimes at the extreme angles, where the teeth are necessarily near each other; but which may be cleaned with the greatest ease, by raising them a little from the ground. The figures 1, 2, &c. point out where the 12 teeth on each side of the harrow are placed.

Where a strong brake-harrow is not necessary, by making the teeth shorter and lighter you may have 48 teeth, which will tear the ground at every two inches, cover the seed well, and make a fine mould.

It is recommended, that harrows for every purpose, and of any size, be made on the above principle; by which no tooth can ever follow the track of another, and all of them will be kept constantly acting.

6. The ROLLER.

¹⁵³
The roller.

The roller is an instrument of capital use in husbandry, though, till of late years, scarcely known in ordinary practice; and where introduced, it is commonly so slight as to have very little effect.

Rollers are of different kinds; stone, cast-iron, wood. Each of these has its advantages. We would recommend these last, constructed in the following manner: Take the body of a tree, six feet ten inches long, the larger the better, made as near a perfect cylinder as possible. Surround this cylinder with three rows of *fellies*, one row in the middle, and one at each end.

Line these *fellies* with planks of wood equally long with the roller, and so narrow as to ply into a circle. Bind them fast together with iron rings. Beech wood is the best, being hard and tough. The roller, thus mounted, ought to have a diameter of three feet ten inches. It has a double pair of shafts for two horses abreast. These are sufficient in level ground: in ground not level, four horses may be necessary. The roller without the shafts ought to weigh 200 stone Dutch; and the large diameter makes this great weight easy to be drawn.

Rolling wheat in the month of April is an important article in loose soil; as the winter rains pressing down the soil leave many roots in the air. Barley ought to be rolled immediately after the seed is sown; especially where grass seeds are sown with it. The best time for rolling a gravelly soil, is as soon as the mould is so dry as to bear the roller without clinging to it. A clay soil ought neither to be tilled, harrowed, nor rolled, till the field be perfectly dry. And as rolling a clay soil is chiefly intended for smoothing the surface, a dry season may be patiently waited for, even till the crop be three inches high. There is the greater reason for this precaution, because much rain immediately after rolling is apt to cake the surface when drought follows. Oats in a light soil may be rolled immediately after the seed is sown, unless the ground be so wet as to cling to the roller. In a clay soil, delay rolling till the grain be above ground. Flax ought to be rolled immediately after sowing. This should never be neglected; for it makes the seed push equally, and prevents after-growth; the bad effect of which is visible in every step of the process for dressing flax. The first year's crop of sown grasses ought to be rolled as early the next spring as the ground will bear the horses. It fixes all the roots precisely as in the case of wheat. Rolling the second and third crops in loose soil is an useful work; though not so essential as rolling the first crop.

In the first place, rolling renders a loose soil more compact and solid; which encourages the growth of plants, by making the earth clap close to every part of every root. Nor need we be afraid of rendering the soil too compact; for no roller that can be drawn by two or four horses will have that effect. In the next place, rolling keeps in the moisture, and hinders drought to penetrate. This effect is of great moment. In a dry season, it may have the difference of a good crop, or no crop, especially where the soil is light. In the third place, the rolling grass seeds, besides the foregoing advantages, facilitates the mowing for hay; and it is to be hoped, that the advantage of this practice will lead farmers to mow their corn also, which will increase the quantity of straw both for food and for the dung-hill.

There is a small roller for breaking clods in land intended for barley. The common way is, to break clods with a mell; which requires many hands, and is a laborious work. This roller performs the work more effectually, and at much less expence; let a harrowing precede, which will break the clods a little; and after lying a day, or a day and a half, to dry, this roller will dissolve them into powder. This, however, does not supersede the use of the great roller after all the other articles are finished, in order to make the soil compact, and

¹⁵⁴
Seasons
rolling.

¹⁵⁵
Effects
of rolling.

ments and to keep out the summer drought. A stone roller of four feet long, and fifteen inches diameter, drawn by one horse, is sufficient to break clods that are easily dissolved by pressure. The use of this roller in preparing land for barley is gaining ground daily, even among ordinary tenants, who have become sensible both of the expence and toil of using wooden mells. But in a clay soil, the clods are sometimes too firm, or too tough, to be subdued by so light a machine. In that case, a roller of the same size, but of a different construction, is necessary. It ought to be surrounded with circles of iron, six inches asunder, and seven inches deep; which will cut even the most stubborn clods, and reduce them to powder. Let not this instrument be considered as a finical refinement. In a stiff clay it may make the difference of a plentiful or scanty crop.

7. The FALLOW-CLEANSING MACHINE.

This was invented by Mr Aaron Ogden, a smith at Ashton-under-Line, near Manchester in Lancashire. It is intended for cleansing fallows from weeds, &c. which exhaust the riches of the soil. A, A, is the frame; B, the first roller; C, the second ditto; in which last are two cranks to move the arms, D, D, which work the rake up the directors fixed on the plank E. The under side of the lower ends or shares of these directors are sharp to cut the clods and let them come on the upper side. Each alternate heel of the share is longer than the intermediate one, that they may not have more than one-half to cut at once. At the back of the plank E are two screws to let it loose, that the directors may be set higher or lower. The shares are to penetrate the ground two or three inches, to raise the quicks till the rake I, I, fetches them into the cart H, where a man must be ready with a muck-hook to clear them backward when gathered. In the rake I are two teeth for every space of the directors, that stones, &c. may be gathered without damage. K, K, are two staples, by which the machine is drawn: under them at h are two hooks, placed low to raise the machine in turning, by the help of the traces; and the axletree of the cart should be fixed upon a pin, that it may turn like a waggon. F, F, are the triggers to throw the rake behind the roots. The long teeth at G, G, are to cleanse the roller C. I, I, is the rake which gathers up the weeds into the cart H, and is drawn above the trigger F by the working of the arms D, expressed by the dotted lines at dd, iii. The triggers F, of which there is one on each side, move on the pivots a; so that when the points b of the rake I have been drawn up by the directors E to the part marked c, the trigger, giving way, permits the rake to pass; but immediately falling, the rake returns along the upper surface of the trigger marked ee, and of course falls on the weeds when it comes to the end, a little beyond the pivot a. The reader will observe, that the boarding is taken away on one side, in the Plate, in order to give a more perfect view of the inner parts of the machine; and in fact it would perhaps be better if all the boarding, marked L, L, L, was taken away, and frame-work put in its stead. The cart H might undoubtedly also be made lighter. The wheels M, M, appear in the Plate to be made of solid wood: but there is no necessity they should be so. At N, is another view of

the roller C, by which the disposition of the spikes may be easily comprehended. Suppose the circle O, described by the end of the roller N, to be divided by four straight lines into eight equal segments, as represented at P. Let the same be done at the other end of the roller, and parallel lines be drawn from one corresponding point to the other the length of the roller; mark the points with figures 1, 2, 3, 4, 5, 6, 7, 8; afterwards draw oblique lines, as from 1, at the end of O, to 2, at the other end, and from 2 to 3, &c.; on these oblique lines the spikes are to be fixed at equal distances, in eight circles, described on the circumference of the roller. The spikes of the small roller B are fixed in the same manner, except that the diameter being smaller, there are only six instead of eight rows. R is another view of the directors, with the plank E on which they are fixed; and S is a section of a part of the plank, with one of the directors as fixed, in which may be seen the heel m, from whence to the point of the share n is a sharp cutting edge. See the same letters in figure R. At T is one of the long teeth to be seen at G; it is bent towards the roller C, which it serves to cleanse. When the end of the rake b, after rising above c, is pushed, by the motion of the arms, D, D, along the upper part e, e, of the trigger F, and comes to the end beyond a; as it falls, the part of the arm marked o rests in the notch p, till it is again raised by the motion of the roller C with the rake. The roller C is to be one foot diameter, the spike nine inches long, that they may go through the furrow (if the soil should be loose) into the hard earth, the more effectually to work the rake, which otherwise might be so overcharged as to cause the roller to drag without turning. In the rake-ends b there should be pivots, with rollers or pullers on, to go in the groove, to take off the friction; and they would likewise take the triggers more surely as the rake comes back. The rake should also be hung so far backward, that when it is fallen, the arms of it may lie in the same plane or parallel with the directors, on which it comes up (which will require the frame to be two inches longer in the model). This will cause the rake to fall heavier, and drive the teeth into the roots, and bring them up without shattering. These teeth must be made of steel, very fine, and so long as to reach down to the plank on which the directors are fixed, that is to say, six inches long (the directors are also to be made six inches broad above the plank). The rake-head should also fall a little before the crank is at its extremity, which will cause the rake to push forward to let the teeth come into the roots. The rake-teeth must drop in the same plane with the roller and wheels, or on the surface of the earth. No more space should be given from the roller C to the long teeth at GG, than that the rake may just miss the spikes of the roller C and fall on the places before mentioned. As the first roller B was intended to cleanse the second C more than for any other use, it may be omitted when the machine is made in large, as Mr Ogden has lately found that the long teeth at GG answer the end alone, and this renders the machine about a sixth shorter. Now, to suit any sort of earth, there should be to each machine three planks, with directors at different spaces to use occasionally; in the first, the spaces between the directors

Instruments of Husbandry. rectors should be eight inches wide, in the second six, and in the third four. This will answer the same end as having so many machines.

As there may be some objections to the rake not leaving the roots when it has brought them up, Mr Ogden has several methods of cleansing it; but as he would make it as simple as possible, he chooses to let it be without them at present; but suppose it should bring some roots back again with it, it will probably lose them before it gets back to the extremity; whence they will lie light, and be but of little detriment to the others coming up. Mr Ogden would have the first machine made four feet six inches wide, the teeth divided into equal spaces, the outsides into half spaces.

8. The new-invented Patent Universal SOWING Machine.

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Universal
sowing
machine,
Plate X.
fig. 1. 2. 11.

This machine, whether made to be worked by hand, drawn by a horse, or fixed to a plough, and used with it, is extremely simple in the construction, and not liable to be put out of order; as there is but one movement to direct the whole, nor does it require any skill in working. It will sow wheat, barley, oats, rye, clover, cole-seed, hemp, flax, canary, rape, turnip, besides a great variety of other kinds of grain and seeds broad-cast, with an accuracy hitherto unknown. It is equally useful in the new husbandry, particularly when fixed to a plough; it will then drill a more extensive variety of grain, pulse, and seed, through every gradation, with regard to quantity, and deliver each kind with greater regularity than any drill-plough whatever. When used in this manner, it will likewise be found of the utmost service to farmers who are partial to the old husbandry, as, among many other very valuable and peculiar properties, it will not only sow in the broad-cast way with the most singular exactness, but save the expence of a seedsman; (the seed being sown either over or under furrow at pleasure), and the land ploughed, at the same operation.

Perhaps a fair and decisive experiment for ascertaining the superior advantage of broad-casting or drilling any particular crop, was never before so practicable; as the seed may now be put in with the utmost degree of regularity, in both methods of culture, by the same machine; consequently the seed will be sown in both cases with equal accuracy, without which it is impossible to make a just decision.

The excellence of this machine consists in spreading any given quantity of seed over any given number of acres with a mathematical exactness, which cannot be done by hand; by which a great saving may be made in seeding the ground, as well as benefiting the expected crop.

There has always been a difficulty in sowing turnip seed with any degree of exactness, both from the minuteness of the seed, and the smallness of the quantity required to be sown on an acre. Here the machine has a manifest advantage, as it may be set to sow the least quantity ever required on an acre; and with an accuracy the best seedsman can never attain to.

It will also sow clover, cole, flax, and every other kind of small seed, with the utmost degree of regularity.

It will likewise broad-cast beans, pease, and tares, or drill them with the greatest exactness, particularly when constructed to be used with a plough.

Another advantage attending the use of this machine is, that the wind can have no effect on the falling of the seed.

Of the Machine when made to be used without a Plough, and to be drawn by a Horse.—It may in this case be made of different lengths at the desire of the purchaser. The upper part AAAA, contains the hoppers from which the grain or seed descends into the spouts. The several spouts all rest upon a bar, which hangs and plays freely by two diagonal supporters BB; a trigger fixed to this bar bears a catch-wheel; this being fixed on the axle, occasions a regular and continual motion, or jogging of the spouts, quicker or slower in proportion to the pace of the person sowing with it drives; and of course, if he quickens his pace, the bar will receive a greater number of strokes from the catch-wheel, and the grain or seed will feed the faster. If he drives slower, by receiving fewer strokes, the contrary must take place. In going along the side of a hill, the strength of the stroke is corrected by a spring which acts with more or less power, in proportion as the machine is more or less from a horizontal position, and counteracts the difference of gravity in the bar, so that it presses, in all situations, with a proper force against the catch-wheel. The spring is unnecessary if the land be pretty level. At the bottom of the machine is placed an apron or shelf in a sloping position; and the corn or seed, by falling thereon from the spouts above, is scattered about in every direction under the machine, and covers the ground in a most regular and uniform manner.

To sow the corn or seed in drills, there are moveable spouts (see fig. 10.), which are fixed on or taken off at pleasure, to direct the seed from the upper spout to the bottom of the furrow.

The machine is regulated for sowing any particular quantity of seed on an acre by a brass slider, A, fig. 7. fixed by screws against a brass bridge on each of the spouts. The machine is prevented from feeding while turning at the ends, by only removing the lever E, fig. 2. out of the channel G, to another at H, on the right hand of it, which carries back the bar from the catch-wheel, and occasions the motion of the spouts to cease, and at the same time brings them upon a level by the action of the diagonal supporters; so that no corn or seed can fall from them.

The machine in this form is particularly useful for broad-casting clover upon barley or wheat; or for sowing any other kind of seed, where it is necessary that the land should first be harrowed exceedingly fine and even.

Manner of using the Machine, when drawn by a Horse.—Place the machine about two feet from the ends of the furrows where you intend it shall begin to sow. Fill the hoppers with seed, and drive it forwards with the outside wheel in the first furrow. When you are at the end of the length, at the opposite side of the field, lift the lever E, fig. 2. into the channel H, and the machine will instantly stop sowing. Drive it on about two feet, and then turn. Fill the hoppers again if necessary; then remove the lever back again into the channel G, and in returning, let the outside wheel of the machine go one furrow within the track which was made by it, in passing from the opposite end; as for example, if the wheel passed down the eighth furrow

row from the outside of the field, let it return in the seventh; and in every following length let the outside wheel always run one furrow within the track made by the same wheel: because the breadth sown is about nine inches less than the distance between the wheels.

Let the machine be kept in a perpendicular situation. If the farmer wishes to sow more or less seed on any one part of the field than the other, it is only raising the handles a little higher, or sinking them a little lower than usual, and it will occasion a sufficient alteration; and should the last turn be less in breadth than the machine, those spouts which are not wanted may be taken up from the bar, and prevented from feeding, by turning the nob above them.

Also, when the land required to be sown has what is called a *vent*, that is, when the sides of the field run in an oblique line to the furrows, which by this means are unequal in length; the spouts must be taken up or let down in succession by turning the knobs, as that part of the machine where they are placed arrives at the ends of the furrows. This is done while the machine is going forwards.

If the land be tolerably level, the machine may be fixed by the screw in the front, and the machine may then be used by any common harrow boy.

Method of regulating the Machine.—In each spout is fixed a bridge (see fig. 7.), with an aperture in it, B, for the grain or seed to pass through. This aperture is enlarged or contracted by a slider, A, which passes over it; and, when properly fixed for the quantity of seed designed to be sown on an acre, is fastened by means of two strong screws firmly against the bridge. This is made use of in sowing all kinds of seed, where it is required to sow from one bushel upwards on an acre. To sow one, two, three gallons, or any of the intermediate quantities, as of clover, cole-seed, &c. the brass plate, fig. 6. is placed between the bridge and the slider, with the largest aperture B downwards, which aperture is enlarged or contracted by the slider as before. To sow turnips, the same plate is placed between the bridge and the slider, with its smallest aperture A downwards, and the hollow part about the same aperture inwards.

Fig. 8. is a view of the regulator, by which the apertures in the several spouts are all set exactly alike, with the utmost ease, to make them feed equally. The extreme height of the largest aperture is equal to the breadth AB, and the breadth at C is equal to the height of the smallest aperture used, viz. that for turnips. The side AC is divided into 60 equal parts, and on it moves the slider or horse D; which being placed

at any particular degree, according to the quantity of seed required to be sown on an acre, is fixed upon it, by a screw on the side of the slider or horse. When this is done, the end of the regulator is put through the aperture in the bridge or plate (whichever is intended to be used), and the slider against the bridge in the spout, raised by it, till it stops against the horse on the regulator: then the slider is fastened against the bridge firmly by the two screws; care being taken at the same time that it stand nearly square.

By this means the spouts (being all fixed in the same manner) will feed equally.

It is easy to conceive that the size of the apertures, and consequently the quantity of seed to be sown on an acre, may be regulated with a far greater accuracy than is required in common practice.

The spouts may be regulated with the utmost nicety, in five minutes, to sow each particular seed, for the whole season. But a little practice will enable any person, who possesses but a very moderate capacity, to make the spouts feed equally, even without using the regulator (B).

Of the Machine, when made to be used by Hand.—The difference of the machine in this case is, that it is made lighter, with but three spouts, without shafts, and is driven forwards by the handles. It hath also a bolt in front, which being pushed in by the thumb, releases the machine; so that it can then easily be placed in a perpendicular position. This alteration is necessary to keep the handles of a convenient height, in sowing up and down a hill, where the slope is considerable; and is done while the machine is turning at the end of the length. The method of regulating and using it is the same as when made to be drawn by a horse.

Of the Machine, when constructed to be used with a Plough.—This is, without doubt, the most useful application of the machine; and it can be fixed without difficulty to any kind of plough, in the same manner as to that represented in fig. 1.

The advantages arising from the use of it are great and numerous; for, beside the increase in the crop, which will be ensured by the seeds being broad-cast with a mathematical nicety, a large proportion of seed (the value of which alone, in a few months, will amount to more than the price of the machine) and the seedsman's labour will be saved. The seed may likewise be sown either under or over furrow; or one cast each way, as is practised by some farmers. The seeds also, being cast by the machine upon the fresh ploughed land, may be immediately harrowed in, before the
Y y 2 mould

(B) Proper directions are given with each machine for using it, as also for fixing the sliders to sow any particular quantity of corn or seed on an acre, so as to enable any person to set the spouts.

The prices of the machine (exclusive of the packing cases) are as follow. If constructed to be used with a single-furrow plough; the wheel, with the axle and cheeks steeled, strap, regulator, brass-plates for broad-casting or drilling turnips, lucerne, tares, wheat, barley, &c. &c. &c. and every article necessary for fixing it included, three guineas and a half. If made with a spring (for sowing on the side of a hill, where the slope is considerable), but which is very rarely necessary, five shillings more. If made to be fixed to any double-furrow plough, four guineas and a half.

The large machine, fig. 2. when made to broad-cast seven furrows at a time and to be drawn by a horse, eight guineas and a half. If constructed to sow five furrows at a time, and to be used by hand, six guineas. These are also five shillings more if made with a spring.

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mould has lost any part of its moisture; which in a dry season will greatly promote the crop. In drilling any kind of grain, pulse, or seed, it possesses every property that can be wished for in the best drill-plough, nor will it (as most of them do) bruise the seed, or feed irregularly. The construction of the machine is the same as the large ones, except being made with one hopper and spout instead of several, and the apron moveable instead of being fixed, as may be seen by inspecting fig. 4. The only alteration necessary to make the machine broad-cast or drill is, in the former case to place the apron B, fig. 1. at the bottom of the machine, upon the hooks FF, sloping either towards the furrows or the unploughed land, according as it is intended to sow the seed either over or under furrow. Whenever the apron is required to be shifted, it is done in less than a second of time; as it only requires to be moved up or down with the hand, when a catch fixes it.

To prepare it for drilling, instead of the apron, place the long spout, fig. 10. upon the brackets, on the front of the machine, by the ears AA, to receive the seed from the upper spout, and fasten the lower end of it, by a small cord, to that hook upon which the apron is hung for broad-casting which is next the plough (see fig. 3.); the seed will then be directed by the long spout, to the centre of the furrow, near the heel of the plough. The spring for correcting the strength of the stroke, is necessary only when they are required to go along the side of a considerable declivity. The machine, when fixed to a plough, does not require the smallest degree of skill in using, as nothing is necessary but to keep the hopper filled, which will contain a sufficient quantity of seed to go upwards of 140 rods, before it will want refilling, when three bushels and a half are sown on an acre. The accuracy with which it will broad-cast, may in some measure be conceived, by considering that the seed regularly descends upon the apron or shelf, and is from thence scattered upon the ground, in quantity exactly proportioned to the speed of the plough: also that each cast spreads to the third furrow; and by this means shuts upon the last. In this manner it is continually filling up till the whole field is completely covered; so that it is impossible to leave the smallest space without its proper quantity of seed.

When the plough is wanted for any other purpose, the machine, with the wheel at the heel of the plough for giving it motion, can be removed or replaced at any time in five minutes.

Fig. 11. represents the machine fixed to a double-furrow creasing plough, and prepared for drilling. As this plough may not be generally known, it will not be improper to observe, that it is chiefly used for creasing the land with furrows (after it has been once ploughed and harrowed); which method is necessary when the seed is to be sown broad-cast upon land that has been a clover ley, &c. because, if the seed be thrown upon the rough furrows, a considerable part of it will fall between them, and be unavoidably lost, by lying too deep buried in the earth. This mode answers extremely well, and partakes of both methods of culture; the seed, though sown broad-cast, falling chiefly into the furrows.

The machine is very useful for sowing in this manner; as the seed is broad-cast, with an inconceivable regularity, at the time the land is creased. The advantages it likewise possesses for drilling all sorts of grain or seed with this plough, are too evident to need mentioning.

The machine, when constructed to be used with a double-furrow plough, is made with two upper and two long spouts for drilling, two aprons for broad-casting, and with a double hopper; but in other respects the same as when intended for a single-furrow plough: it is used in all cases with the greatest ease imaginable.

The interval between the points of the two shares of a creasing plough is usually ten inches; the beam about nine feet long; and the whole made of a light construction.

Amore particular explanation of the figures.—Fig. 1. Plate XI. The machine fixed to a Kentish turn-wrest plough. A, The machine. B, The apron upon which the seed falls and rebounds upon the land, in broad-casting. C, Lid to cover the hopper. D, Wheel at the heel of the plough. E, Scrap. FF, Hooks, upon which the apron turns by a pivot on each. G, Stay, to keep the machine steady: H, Lever, to prevent it from sowing.

Fig. 2. The machine constructed to be drawn by a horse. AAAA, The hoppers. BB, The diagonal supporters. CCCC, The upper spouts. D, The apron or shelf upon which the seed falls upon the upper spouts. E, The lever, which carries back the bar, and prevents the machine from sowing. FF, Staples upon the handles, through which the reins pass, for the man who conducts the machine, to direct the horse by. I, Screw, to fix the machine occasionally. N. B. The knobs (by turning which each particular spout may be taken from off the bar, and thereby prevented from feeding) are over each upper spout; but, to prevent confusion, are not lettered in the Plate.

Fig. 3. is the same machine with that in fig. 1. The dotted lines, expressing the situation of the long spout, when the apron is removed, and the machine adapted for drilling.

Fig. 4. Also the same machine, with the front laid open to show the inside. A, The catch-wheel fixed upon the axle. BB, The axle upon which the machine hangs between the handles of the plough. C, The pulley, by which the strap from the wheel at the heel of the plough turns the catch-wheel. D, The bar, upon which the upper spout rests, suspended by the diagonal supporters EE, bearing against the catch-wheel by the trigger F, and thereby kept in motion while the plough is going. G, The apron in a sloping position, upon which the corn or seed falls from the upper spout, and is scattered by rebounding upon the land. It turns upon pivots, and by this means throws the seed either towards the right hand or left at pleasure.

Fig. 5. The upper spout.

Fig. 6. The plate which is placed between the bridge and the slider, for sowing small seeds. The aperture A being downwards for sowing turnips; the larger one B downwards for sowing clover, &c.

Fig. 7. The bridge, fixed in the upper spouts. A, The slider, which contracts or enlarges the different apertures.

Preparation of Land. apertures. B, The aperture in the bridge, through which the seed passes, when sowing any quantity from one bushel upwards on an acre.

Fig. 8. The regulator, made of brass. D, The slider or horse which moves upon it, and is fixed at any particular degree by a screw in its side.

Fig. 9. represents the movement in the machine fig. 2. AAAA, Cleets, between which the upper spouts rest. BB, The diagonal supporters, by which the bar with the upper spouts hang. C, The catch-wheel. DD, The axle. E, The trigger upon the bar, which bears against the catch-wheel. FF, Stays from the back of the machine, by which the bar plays.

Fig. 10. The long spout. AA, The ears by which it hangs.

SECT. II. *Of preparing Land for cropping, by removing obstructions and bringing the Soil into a proper state.*

I. OF REMOVING STONES.

It is of the utmost importance to have land effectually cleared of stones, before undertaking any agricultural operation upon it; for by means of them there is frequently more expence incurred in one season, by the breaking of ploughs and the injury suffered by the cattle and harness, than would remove the evil. It has also been observed that the soil round a large stone is commonly the best in the field. It may be considered as purchased at a low rate by removing the stone. At any rate, such stones must be removed before the ground can be properly cultivated. For whether a large stone occupy the surface, or lie beneath it, but within reach of the plough, a considerable space around it cannot be stirred by that instrument, and is therefore useless. Even the rest of the field where stones abound must be laboured in a more slow and tedious manner, on account of the caution necessary to avoid the danger which they produce.

The stones which impede the improvement of land are, 1st, loose stones, or such as are thrown up to the surface by the plough; and, 2dly, sitfast stones, which are either upon or immediately below the surface, but are of such magnitude that they cannot be stirred by the plough. The first kind of stones may usually be easily removed by being gathered and carried off. When land is laid down for hay, such stones are often improperly thrown in heaps into the furrows, where they ever after continue to interrupt the plough, or are dragged again by the harrows over the land. Instead of proceeding in this manner, they ought to be carried wholly off the field in carts at the driest season of the year, and placed in situations in which they may be rendered useful to the farm. In this point of view, stones are sometimes of considerable value for making concealed drains, or for making and repairing the roads through a farm, and also for the repairs of some kinds of fences.

The only writer upon agriculture who has in any case objected to the propriety of clearing land of small stones, is probably Lord Kames. In some parts of the south of Scotland, and particularly in Galloway, the soil is said to be composed in a great measure of gravel, and of stones of a smooth surface, as if worn

by the running of water. After being ploughed, the whole surface of every field appears to be composed of loose stones lying almost in contact with each other. Some industrious farmers, with great labour, collected and removed the stones from a few of their fields with a view to their improvement: and the result is said to have been, that the succeeding crops were wholly blighted in the tender blade, and never came to maturity. The stones upon the surface were supposed to have prevented the exhalation of the moisture from the shallow and extremely porous and open soil which they covered: and they were also supposed to have contributed to foster the young plants, by reflecting powerfully from their smooth surfaces the sun's rays in every direction around them: but when they were removed, the soil, in that bleak climate, became at once too cold and too dry for any purpose of agriculture. The farmers, therefore, who had with so much toil and cost removed the stones from part of their lands, could think of no better remedy than, with equal toil, to bring them all back again, and carefully replace them upon their fields. It is added, that the soil immediately resumed its wonted fertility. The truth of this anecdote has never been contested; and there is no doubt that it has long been current in the south of Scotland, both previous to its publication by Lord Kames, and after that period, among a class of persons who are very unlikely to have been acquainted with his writings. It is possible that the replacing the stones was the best remedy for the want of fertility in the soil which its cultivators had within their reach: but it is probable that they might have found it of more importance to have covered the surface of their land with a substantial coat of clay marl, or even with almost any kind of earth or clay obtained from the bogs and swamps that usually abound in these countries, providing only they could obtain a quantity of lime to add to it. In this way, possessing land whose bottom was very pervious to moisture, they might have obtained a soil suited to every purpose of agriculture; whereas, in its present state, it must remain for ever unfit to be touched with the scythe.

With regard to large or sitfast stones which cannot be removed by any ordinary effort, they usually either appear fully above the surface or are concealed immediately under it. For the sake of discovering concealed stones, it is said to be a custom in Yorkshire, when they intend to reduce waste and rude land under the plough, in the first place, carefully to go over the whole surface with sharp prongs, which at the distance of every twelve or fourteen inches they thrust into the ground to the depth of above a foot, and wherever a stone meets the prong, they mark the spot with a twig, a bit of wood, or some other object. They afterwards trace all the marks, and remove every stone before they touch the land with the plough.

Concerning the modes which have been adopted for removing large stones out of the way of the plough; one of the simplest is the following: A pit or hole is dug beside the stone, 16 or 18 inches deeper than the height or thickness of the stone. A number of men are then assembled, who tumble it into the pit. It is immediately covered up with a part of the earth that came out of the hole; and the rest of the earth is scattered over the field, or employed in bringing to a level with the rest of the soil the spot where the stone formerly

formerly

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By the above operation, however, the stones are utterly lost; whereas they may sometimes be of considerable value for fences or other buildings. When this is the case, they must be broken to pieces before they are removed. With this view it is to be observed, that a great variety of stones have some thin veins, which being found, wedges can be driven into them by large hammers, so that they may be easily broken. For such operations spades and pick axes are necessary to clear away the earth, and a large and a small lever to turn the stones out of the ground. Hammers and wedges are also requisite, with carts to remove the fragments from the field. In the Statistical Account of Scotland, vol. xix. p. 565. parish of Maderty, we are told that "the Rev. Mr Ramsay, the present incumbent, who occupies a piece of land full of sitfast stones, constructed a machine for the purpose of raising them. It operates on the principles of the pulley and cylinder, or wheel and axis, and has a power as one to 24; it is extremely simple, being a triangle, on two sides of which the cylinder is fixed; it can be easily wrought and carried from place to place by three men. A low four-wheeled machine of a strong construction is made to go under the arms of the triangle, to receive the stone when raised up. This machine has been already of great use in clearing several fields of large stones in this place and neighbourhood."

It is evident, that the machine here described is only valuable for getting stones out of the way in the gross and unbroken; and, accordingly, we learn that stone fences are almost unknown in the parish of Maderty.

Where stones are valuable, therefore, and the operation of breaking them with hammers and wedges is found impracticable or too laborious, it will be necessary to blast them with gunpowder. To perform this operation properly, however, considerable experience is requisite; for it is said, that a skilful workman can in most instances, by the depth and position of the bore, contrive to rend stones into three equal pieces without causing their fragments to fly about. In time of war, however, the expence of gunpowder is apt to become very great. With a view to diminish the cost of that article, it has been suggested, that it is proper to perform the operation not with gunpowder alone, but with that article of a good quality, mixed up with about one-third of its bulk of quicklime in fine powder. It is said that this composition possesses as much force as an equal quantity of pure gunpowder, and it is even alleged, that the proportion of quicklime may be increased with advantage. How the strength of gunpowder should be so much augmented by the addition

of quicklime, we do not know. Perhaps it may add to the force of the explosion by undergoing a chemical decomposition of its parts, as it has of late been suspected, that this mineral is by no means a simple or uncompounded body.

Where a field is very greatly overrun with concealed stones, the most effectual method of getting quit of them, and of rendering it permanently arable, consists of trenching it wholly by the spade. Nor is this always the most expensive mode of proceeding. The trenching can be done at the rate of from 3l. to 4l. *per Scots acre*, which is one-fourth larger than an English acre, allowing at the same time the stones or their price at the quarry to the labourers. In this way, the expence of ploughing the field is saved. The soil is deepened to the utmost extent of which it is capable, and can be laid out in the form most convenient for cultivation. In Dr Anderson's report of the state of agriculture in Aberdeenshire, it is said that the expence of trenching an acre to the depth of from 12 to 14 inches, where the stones are not very large and numerous, runs from 4d. to 6d. a fall, which is from 2l. 13s. to 4l. *per Scots acre*. Ground that has been formerly trenched, is sometimes done as low as 2d. *per fall*, or 1l. 6s. 6d. *per acre*. Hence, in consequence of the practice of trenching ground by the spade being not unfrequent in Aberdeenshire, workmen have become expert, and by competition have rendered the price extremely moderate. It is to be wished that the same practice were more frequent in other parts of the country, as it would have a tendency to introduce a taste for the most correct and perfect of all modes of labouring the soil, and would also occupy a considerable part of the population of the country, in the most innocent and healthful of all employments, that of agriculture.

2. OF DRAINING.

It has already been remarked, that the presence of moisture is of the utmost importance to the success of vegetation. At the same time, as must necessarily happen with every powerful and active agent, the too great abundance of water is no less pernicious to many plants, than an entire want of it. When it stagnates upon the soil, it decomposes or rots the roots and stems of the most valuable vegetables. Even when it does not remain on a spot round the whole year, its temporary stagnation during the winter renders the land unproductive. Seasons of tillage are often lost, and in wet years the crop must always be scanty and precarious. When in grass, the land can only produce the coarsest and most hardy vegetables, which can resist the chill or cold state of the soil, or the fermentation which is often produced by sudden warmth while the water remains upon the ground. Hence arises the importance of draining, by which arable land is rendered manageable, is made to dry gradually and early in the spring, and the corn is increased in quantity and weight; and by which, in pasture lands, the grasses are made to change their colour and to lose their coarse appearance, and the finer kinds of plants are enabled to flourish. Even the climate is, by means of draining, very considerably improved. It is rendered less cold during the winter, and by diminishing in hot weather the exhalations from the soil, its salubrity both to animal and vegetable

Land preparation table life is greatly increased. Every kind of grain comes earlier to maturity. The harvest is less precarious, and the diseases are banished which arose from a damp soil and humid atmosphere.

The water which stagnates upon the surface of a soil may originate from two causes. It may descend upon it in the form of rain, or it may ascend from springs or reservoirs of water in the bowels of the earth. The rules for draining land which is rendered too wet for the purposes of agriculture are different, according to the causes which occasion the wetness. We shall first take notice of the most approved modes of draining, when the excessive moisture is occasioned by rain water stagnating upon the land; and we shall afterwards take notice of the plan of draining to be adopted, when the wetness arises from springs or water arising out of the earth.

To relieve land from rain water that is apt to stagnate upon it, two kinds of drains have been adopted. One of these is called *open drains*, from their being exposed to view in their whole length. The other kind receives the appellation of *hollow drains*, from their being covered, so that their existence is not apparent to a stranger, nor is any part of the land lost in consequence of their being made. Hollow draining is sometimes avoided on account of the great immediate expence with which it is attended, and in some situations it is altogether inadequate to the object in view. There are some soils that being chiefly composed of a stiff clay, possess so great a degree of tenacity as to retain water upon every trifling depression of their surface, till evaporation carries it off. It is in vain to attempt to drain such soils by hollow channels below ground, as the water will never be able to filtrate through the soil so as to reach the drain. In such situations, therefore, open draining is the only mode that can be adopted for clearing the soil of surface water.

It also sometimes happens that, on ordinary soils, hollow drains would speedily be rendered useless. This must take place where the admission of surface water cannot be avoided, and, from the figure of the adjoining lands, must be very greatly augmented in time of heavy rains. In such cases, a close or hollow drain would speedily be choked up by the sand and soil brought down by sudden and violent torrents. In these situations, therefore, open drains can alone prove useful.

Soils formed of a tenacious clay can only be drained by being laid up properly in ridges which are high in the middle, and have furrows at each side for carrying off the water. The great art of preserving land of this description, therefore, free from superfluous moisture, consists of laying out every field in such a direction as that all the furrows between the ridges may have a gradual descent to a common ditch or drain for carrying off the water. Where at any particular spot the regularity of the descent is interrupted, cross furrows must be kept open with the same view. The ridges must also be laid up in such a form as to allow the water to descend from the summit in the middle to the furrows on each side. If the ridges, however, are too high in the centre, there will be a danger that in heavy rains the soil may be washed from the summit down into the furrows, which would produce the double evil of impoverishing the centre of every ridge, and of

choking up the furrows, and rendering them unfit to drain the land.

The distinguished success of the Flemish husbandmen, and also of the farmers in the central counties of England where this kind of soil abounds, sufficiently demonstrates the practicability of preserving it in a due degree of dryness for the most valuable purposes of agriculture. In these English counties, and in Flanders, the general mode of drying land consists of ploughing it up in high and broad ridges, from 20 to 30 and even 40 feet wide, with the centre or crown three or four feet higher than the furrows. By attentively preserving the furrows in good order, and free from stagnating water, the land is kept in a dry state, and all kinds of crops flourish.

The mode of ridging and cross-furrowing the clay soil of the Carse of Gowrie, Perthshire, has been thus described by George Paterson, Esq. of Castlehuntingly in that county. There are certain large common drains which pass through the district in different directions, sufficiently capacious to receive the water drained from the fields by the ditches which surround them, and of such a level as to carry it clear off, and to empty their contents into the river Tay. There are also ditches which surround every farm, or pass through them as their situation may require, but in such manner as to communicate with every field upon the farm. These ditches are made from two to four feet wide at top, and from one and a half to one foot at bottom; a shape which prevents their sides from falling in: but even then they must be cleansed and scoured every year at a considerable expence. If the fields be of an uniform level surface, the common furrows between the ridges, provided they be sufficiently deepened at their extremities, will serve to lay the grounds dry; but, as it seldom happens that any field is so completely free of inequalities, the last operation, after it is sown and harrowed in, is to draw a furrow with the plough through every hollow in the field which lies in such a direction that it can be guided through them, so as to make a free communication with any of the ditches which surround the farm, or with any of the furrows between the ridges which may serve as a conductor to carry the water off to the surrounding ditches. When this track is once opened with the plough, it is widened, cleared out, and so shaped with the spade, that it may run no risk of filling up. Its width is from six inches to a foot according to its depth, which must depend upon the level of the field; but the breadth of a spade at bottom is a good general rule. It frequently happens that there are inequalities in several parts of the same field, which do not extend across it, or which do not pass through it in any direction that a plough can follow; but which may extend over two ridges, or one ridge, or even part of a ridge. Such require an open communication to be made with any furrow, which may serve as a conductor to carry off the water, which is always made with the spade. All these open communications are here called *gaas*, and to keep them perfectly clear is a very essential object of every Carse farmer's attention.

It is the general practice in the Carse to have head-ridges, as they are called, at the two extremities of each field; that is, the ground upon which the plough turns,

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Rules for making open drains.

With regard to the general rule for making open drains, it may be observed that their depth and wideness must always in some measure be left to the judgement of each particular husbandman, that they may be varied according to the variety of soils and situations. Upon the whole, however, the width at bottom ought to be one third of that at top, that, by being sufficiently sloped, the sides may be in no danger of falling in. The fall or declivity also should be such as may carry off the water without stagnation, and along with it any grass and other loose and light substances that may get into the ditch. At the same time, care ought to be taken to lead the drain in such a direction down any steep declivity that may occur in an oblique manner, that the water may not have too rapid a motion, as it would otherwise be apt to form inequalities in the bottom, and to wear down the sides. In moss and very soft soils, drains require to be of considerable width, on account of their tendency to fill up; and their breadth at top must exceed that at the bottom in a greater degree than the proportion already mentioned. In all cases in which a ditch is intended for a drain only, and not to be used as a fence, none of the earth thrown out of it ought to be allowed to remain upon the sides, but should be spread abroad upon the land, or used in filling up the nearest holes. When this is not done, the utility of the drain is injured by the surface water being prevented from reaching it, and by the tendency which this weight of earth has to cause the sides to fall in; the difficulty of scouring or cleaning it is thus also much increased. If it be necessary, however, to use the ditch, and the earth thrown out of it, as a fence, a deep furrow ought to be made along the back of the mound of earth, with openings in convenient places into the ditch for transmitting to it the water collected in the furrow.

In plantations, open drains are the only kind that can be used, as the roots of the trees would be apt to choke up covered rains. In pastures, small and narrow open cuts, made with the plough or otherwise, are often extremely useful, to carry off stagnating water and a part of the rain as it falls. The only objection to them is, that they are easily stopt by the trampling of the cattle; but, on the other hand, they are easily restored. Concerning all open drains, indeed, it must be remembered, that they require to be cleaned out at least once a year; and when this process is neglected for any length of time, it becomes more difficult, and the drains lose their effect. Hence, though open drains are originally cheaper, yet, by the necessity of annual repairs, they sometimes become ultimately more expen-

sive than covered or hollow drains, to the consideration of which we shall next proceed.

Hollow drains, in which the water is allowed to flow along a bed of loose stones, or other porous materials, while they are covered with a bed of earth in which the operations of the plough can proceed, bear a near resemblance to that part of the constitution of nature by which water flows in various channels along beds of porous strata in the bowels of the earth, and coming to the surface in various situations, supplies springs and the constant flow of rivulets and of the largest streams. The practice of hollow draining was known in a very remote antiquity. It is said that the present Persians are supplied by means of hollow drains with water in their most fertile fields, though they know not from whence the water is brought, and are unacquainted with the arts by which a more ingenious people in former times contrived to deprive one part of the soil of its superfluous moisture with a view to enrich another. The ancient Roman writers, Cato, Palladius, Columella, and Pliny, particularly mention the practice of hollow draining. They knew the kind of soils in which these drains are useful, and the propriety of directing them obliquely across the slope of the field. They filled them half way up with small stones, and for want of these with willow poles, or even with any coarse twigs or other similar materials twisted into a rope. They also fortified the heads of their drains with large stones, and their mouths or outlets with a regular building; and they carried the whole drain to the depth of three or four feet.

As already mentioned, hollow drains are of little value in a soil that consists of a stiff clay, and are chiefly useful where, from whatever cause the wetness may result, the soil is sufficiently porous to allow the moisture to percolate to an internal drain.

If the field proposed to be drained lie on a declivity, great care should be taken to make hollow drains in a making direction sufficiently horizontal to prevent a too rapid fall of the water, which might wear the bottom uneven, and have the effect to choak, or, as it is sometimes called, to *blow up* the drain, whereby, in certain spots in the field artificial springs would be formed.

Concerning the season for executing drains, discordant opinions are entertained. Some prefer winter, others summer. Where much work is to be accomplished, a choice of seasons may not indeed be left to the husbandman. Some farmers, however, when they have the choice of time, always prefer summer for this employment, being then able to execute the cuts in a neater manner, without that kneading of the soil which takes place in winter, which they think hurts the usefulness of the drain, by ever after preventing the water from easily finding its way to it; besides that it is easier to bring the stones or other materials to the spot in summer than in winter. Others, however, prefer draining in winter, because in the case of a clay soil, the labour is at that season much easier; and also because labourers are then usually most easy to be obtained.

The depth and width usually adopted for hollow draining is very various, according to the nature of the soil and the situation of the field. When the practice first came into general use, three feet is said to have been the common depth; but, for many years past, it

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Preparation of Land. it is said that hollow drains seldom exceed 30 or 32 inches, and that more drains are of two feet, or 26 inches deep, than of any other. One general rule, however, cannot be neglected with safety, that the depth must be sufficient to prevent the materials with which the drain is filled from being affected by the feet of horses in a furrow while ploughing; twenty-four inches is perhaps too little for this purpose. A horse's foot in a furrow is usually at the depth of four inches or more. If ten inches additional be allowed for the materials employed in filling the drain, there will remain only nine or ten inches to support the foot of a horse exerting his strength in the act of ploughing, which upon a porous soil seems scarcely sufficient. What are called *main drains*, which are those intended to receive the water of several other drains, must always be somewhat deeper than the rest, having more water to convey. As to the wideness of hollow drains, most farmers have of late been solicitous to render them as narrow as possible, because by this means a great saving takes place of the materials used for filling them. If the stones are coupled at the bottom of the drain; that is, made to lean toward each other, so as to constitute a triangle, of which the bottom of the drain forms the base, the width need not be greater than one foot. That the ditches or cuts which are meant to be converted into hollow drains may be executed with neatness and care, a point of much importance to their usefulness, it is thought prudent that the workmen should not be paid according to the extent of ground which they open, but as day labourers. This, however, is more particularly the case with regard to filling the drains, an operation in which a still greater degree of attention is necessary.

Materials. The materials used for filling drains have been various, according to the substances which different farmers have been able to obtain. Stones, however, are the most common, and also the best of all materials, on account of their permanency. If stones from quarries are to be used, and the drain formed like a conduit at the bottom, the trench must be made at the lowest part 16 inches wide, containing two side stones about six inches asunder, and the same in height, with a cap or flat stone laid over, which secures the cavity. Such hollow drains are commonly used for permanent currents of water from springs, and are more expensive than where no such steady current exists, and the stones are either thrown in promiscuously, or laid down so as to form triangular cavities. The stones ought to be very clean, having no clay or earth adhering to them, and of the most hard and permanent quality that can be procured, with as little tendency as possible to moulder or decay in consequence of alternate changes from wet to dry. They ought also to be laid in carefully, so as not to tumble down any earth, which might choke up their interstices. The whole subject, however, will be better understood by a statement of the way in which drains have been filled with success by intelligent persons.

The following directions are given by T. B. Bayley Esq. of Hope, near Manchester: "First make the main drains down the slope or fall of the field. When the land is very wet, or has not much fall, there should in general be two of these to a statute acre; for the shorter the narrow drains are, the less liable they will be to

accidents. The width of the trench for the main drains should be 30 inches at top, but the width at the bottom must be regulated by the nature and size of the materials intended to be used. If the drain is to be made of bricks, 10 inches long, 3 inches thick, and 4 inches in breadth, then the bottom of the drain must be 12 inches; but if the common sale bricks are used, then the bottom must be proportionably contracted. In both cases there must be an interstice of one inch between the bottom brick and the sides of the trench, and the vacuity must be filled up with straw, rushes, or loose mould. For the purpose of making these drains, I order my bricks to be moulded ten inches long, four broad, and three thick; which dimensions always make the best drain."

The method which this gentleman pursues in constructing his main drains is stated by him to be the following: When the ground is soft and spongy, the bottom of the drain is laid with bricks placed across. On these, on each side, two bricks are laid flat, one upon the other, forming a drain six inches high, and four broad, which is covered with bricks laid flat.—When the bottom of the trench is found to be a firm and solid body, such as clay or marl, he formerly thought that it might not be necessary to lay the bottom with brick; but in this he has candidly acknowledged that he was quite wrong. By the runs of water, the alternate changes from wet to dry, and the access of air, these hard bottoms were rendered friable, crumbled away, and let in all the drains, and allowed them to choke up, that were not supported by a bottom laid with brick or stone. When stones are used instead of bricks, Mr Bayley thinks that the bottom of the drain should be about eight inches in width; and in all cases the bottom main drains ought to be sunk four inches below the level of the narrow ones whose contents they receive, even at the point where the latter fall into them.

The main drains should be kept open or uncovered till the narrow ones are begun from them, after which they may be finished; but before the earth is returned upon the stones or bricks, it is advisable to throw in straw, rushes, or brushwood, to increase the freedom of the drain. The small narrow drains should be cut at the distance of 16 or 18 feet from each other, and should fall into the main drain at very acute angles, to prevent any stoppage. At the point where they fall in, and eight or ten inches above it, they should be made firm with brick or stone. These drains should be 18 inches wide at the top, and 16 at bottom.

A mode of draining clay soils wet by rain or surface water, practised by Sir Henry Fletcher, Bart. with great success, seems worthy of being here stated. The upper soil is of good quality, but being situated in a mountainous part of the country, the frequent rains kept the upper soil so full of water, that it produced only a coarse grass worth 3s. per acre. The inferior soil of clay was of great depth. The mode of draining which has been successfully practised upon it is the following: "On grass lands he digs 22 inches, or 2 feet deep; the first spadeful is of the turf, taken so deep, as where it separates from the clay, which is dug carefully out, and preserved unbroken grass side up, and laid on one side of the cut; then, with a very strong spade, 18 inches long, 6 inches wide at top, and 2 at the bottom, he digs a spadeful in the clay, which

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the men spread about the land, on the side of the drain opposite to where the turfs were laid, as far as possible from the drain, so as none may get in again. A scoop, to clear out the fragments in the bottom, follows, which are also spread in like manner. They are then ready for filling; and in doing this, he takes three stones of a thin flat form, two of which are placed against the sides of the drain, meeting at bottom; and the third caps the other two. Thus, a hollow triangular space is left to convey the water, which is subject to no accidents that can fill it up or impede the current. Stones always sink deeper in the ground; in the common method, this frequently causes stoppages by their being partly buried in the clay: but the triangle, when it subsides, does it regularly, and keeps its form and the passage for the water clear. One cart load of stones, in this way, will do a considerable length of drain. They are carefully laid down by the side of the cut, with a shovel or basket, and if there are any small refuse stones left on the ground after the drain is set, they are thrown in above. The stones being thus fixed, the sods are then trimmed to the shape of the drain, and laid on them, with the grass side downwards, and none of the clay used in filling up.

The expence is a halfpenny per yard, the men earning 2s. and 2s. 6d. per day, at 10 yards distance from drain to drain. At 6 yards distance they answered well, but would not operate a cure, if more than 7 yards asunder. At this last distance, therefore, the expence of draining an English acre, at $\frac{7}{8}$ d. per yard, would amount to 1l. 9s. 2d. the stones being not more than half a mile distant.

Not only stones and bricks, but also wood and other materials, have been used for filling drains.

Richard Preston, Esq. of Blackmore, prefers, on twenty years experience, black thorns to every other material for filling drains. Wood is sometimes used with this view in the following manner: Two billets are placed at opposite sides of the drain, and each is made to rest under the opposite side to that on which its lower part stands, so as to form with each other a St Andrew's cross. The upper part of the cross is filled with brushwood, laid longitudinally, above which straw is placed cross-ways, and the mould is thrown in over all. This kind of drain is said to have continued running in Berwickshire for 30 years, and it is recommended by the Author of the Agricultural Report of the county of Caermarthen, in Wales. He says, "The completest method I have yet known, is to cut the strongest willows, or other aquatic brushwood, into lengths of about 20 inches, and place them alternately in the drain, with one end against one side of the bottom, and the other leaning against the opposite side. Having placed the strong wood in this manner, I fill the space left between them on the upper side with the small brushwood, upon which a few rushes or straw being laid, as before mentioned, the work is done. Willow, alder, asp, or beech boughs, are exceedingly durable if put into the drain green, or before the sap is dried; but if they are suffered to become dry, and then laid under ground, a rapid decay is the consequence. I have seen willow taken out of a bog, after lying there thirty years, and its bark was as fresh and sappy as if it had been recently cut from the hedge;

and it is well known that beech laid green in the water will continue sound for any length of time."

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Another method of using wood consists of fixing at every foot distance in the drain, a stick in the form of a semicircular arch, and of laying upon these longer branches or twigs longitudinally. Thus is a curved cavity, or arch, formed beneath, capable of supporting any weight of earth. For this purpose young wood is recommended, and in particular the prunings of larch.

Instead of wood or stone, in many places, it has of late become customary to fill the lowest part of drains with straw, and with that view to make use of wheat stubble as the cheapest kind of straw. On this subject, Mr Vancouver, in his Report of the Essex husbandry, remarks, that when the soil is a very close and retentive clay, the drains should be made proportionally near to each other, shallow, and filled with straw only, it being totally unnecessary to use wood or any more durable material upon land where the sides of the drains are not likely to crumble in. He asserts that drains formed in this manner, through the tough and retentive clays, will be found in a short time after the work is finished, to afford over the straw, with which the drain was filled, an arch of sufficient strength to support the incumbent weight of the soil, and the casual traffic of the field. "In 12 or 18 months it may be observed that the straw, being of one uniform substance, is all rotted, and carried away, leaving a clear pipe through the land in every drain, into which the passage of the water may have been much facilitated, by a due attention to the filling of the drains with the most friable and porous parts of the surface the field might have afforded."

An improvement in filling hollow drains with straw, consists of twisting the straw into a rope, said to have been devised by Mr Bedwell, of Essex. The rope of straw is formed as large as a man's arm, and is placed at the bottom of the drain. The expence of draining an English acre of land with this material in Essex, is said to stand thus:

For cutting and raking together an acre of wheat stubble, generally sufficient for an acre of drain,	-	-	L. 0	2	0
Digging eight score rods of drains	-	-	0	13	4
Filling them up with stubble,	-	-	0	2	8
Extra work with the common spade, on an average a day's work for a man,	-	-	0	1	4
			L. 0	19	4

As in some situations it is an object of great importance to save the expence of materials commonly used in filling drains, a variety of devices have with that view been adopted. One of these is of the following nature. A drain is first dug to the necessary depth, narrow at bottom. Into the trench is laid a smooth trec, or cylindrical piece of wood, 12 feet long, 6 inches diameter at the one end, and 5 at the other, having a ring fastened into the thickest end. After strewing a little sand upon the upper side of the tree, the clay or toughest part of the contents of the trench, is first thrown in upon it, and thereafter the remainder of the earth is fully trod down. By means of a rope through the ring the tree is then drawn out to within a foot or two of

Preparation of the small or hinder end, and the same operation is repeated till the whole drain is complete. Such a drain is said to have conducted a small run of water a considerable way under ground for more than 20 years without any sign of failure.

What is called the sod or pipe drain consists of a trench dug to a proper depth; after which a last spadeful is taken out in such a way as to leave a narrow channel, which can be covered by a sod or turf dug in grass land and laid over it, the grass side downwards. Such drains are said to continue hollow, and to discharge well for a great number of years. Mosses are said to be drained in Lancashire nearly in the same manner, by leaving shoulders about a foot and a half from the bottom of the trench, and laying across these pieces of dried peat or turf, cut into lengths of 16 inches, and 8 or 9 inches in breadth.

In Buckinghamshire, in grass lands, the sod drain is thus made: When the line of drain is marked out, a sod in form of a wedge is cut, the grass side being the narrowest, and the sods being from 12 to 18 inches in length. The drain is then cut to the depth required, but is contracted to a very narrow bottom. The sods are then set in with the grass side downwards, and pressed as far as they will go. As the figure of the drain does not suffer them to go to the bottom, a cavity is left, which serves as a water course; and the space above is filled with the earth thrown out.

Another invention for draining land is described in the agricultural report of the county of Essex. It consists of a draining wheel of cast iron, that weighs about 4 cwt. It is 4 feet in diameter, the cutting edge or extremity of the circumference of the wheel is half an inch thick, and it increases in thickness towards the centre. At 15 inches deep it will cut a drain, one half of an inch wide at the bottom, and 4 inches wide at the top. The wheel is so placed in a frame, that it may be loaded at pleasure, and made to operate to a greater or less depth, according to the resistance made by the ground. It is used, in winter, when the soil is soft; and the wheel tracks are either immediately filled with straw ropes and lightly covered over with earth, or they are left to crack wider and deeper till the ensuing summer; after which the fissures are filled with ropes of straw or of twisted twigs, and lightly covered with the most porous earth that is at hand. Thus, upon grass or ley lands, hollow drains are formed at a trifling expence, which answer extremely well. It is said that 12 acres may be fully gone over with this draining wheel in one day, so as to make cuts at all necessary distances.

On sheep pastures a still simpler mode of removing surface water is said to be practised in some places. Wherever the water is apt to stagnate, a deep furrow is turned up with a stout plough. Thereafter, a man with a spade pares off the loose soil from the inverted sod, and scatters it over the field, or casts it into hollow places. The sod thus pared and rendered thin, or brought to the thickness of about three inches, is restored to its original situation, with the grassy side uppermost, as if no furrow had been made. A pipe or opening is thus formed beneath it two or three inches deep in the bottom of the furrow, which is sufficient to discharge a considerable quantity of surface water which readily sinks into it. These furrows, indeed,

are easily choked up by any pressure, or by the growth of the roots of the grass; but they are also easily restored, and no surface is lost by means of them.

With regard to the duration of hollow drains, or the length of time that the water will continue to flow in them, and thereby to preserve the soil in a proper state of dryness, it must necessarily depend, in a great degree, upon the nature of the materials with which they are filled, and the care that has been taken to prevent their being choked up by any accession of soft soil. Independent of this last circumstance, a drain filled with stones, like the channel which supplies a natural spring, may endure for ever. Wood, with which many drains have of late years been filled, perishes at certain periods according to its nature; but it does by no means follow, that the drain should lose its effect in consequence of the destruction of the wood. If the earth over it form itself into an arch, the water will still continue to flow. Accordingly, it is said, that drains filled with bushes and straw have been known to run well after 40 years.

Having thus stated the various modes that have been most successfully adopted for draining lands of a superabundant moisture caused by rain or surface water, we shall proceed to consider the way in which a soil may be drained when its undue wetness is the consequence of natural springs, or of water arising out of the bowels of the earth; and also when the soil, whether injured by springs or rain water, is so completely surrounded by higher grounds, as to prevent the possibility, at a moderate expence, of obtaining a level by which the water may be conducted away, either by open or by artificial hollow drains.

To understand the principles upon which land, rendered wet by springs, may be drained for the purposes of agriculture, it is necessary to attend to the materials of which the globe we inhabit is composed, and to the manner in which large quantities of water find their way into its bowels. The earth upon which we tread is by no means an uniform mass of matter. It consists of various layers or strata of different substances, one placed over the other. These layers or strata are seldom situated horizontally, but almost always descend towards one side or the other. One part of a stratum or layer often descends and appears on the surface, while the other end or side of it descends obliquely to a great depth into the earth. Having done so, it frequently again bends upwards towards the surface; and indeed assumes almost all the variety of irregular forms and bearings that the imagination can conceive; sometimes suddenly breaking off and giving place to other strata or layers, and sometimes continuing at one corner while the greater part of it ceases. These strata or layers, of which the earth is composed, may be considered, with a view to the explanation of our present subject, as of two kinds. Some of them are porous, and allow water to pass through their substance, and to fill up all their cavities and interstices, such as sand, gravel, some marls, and various kinds of porous rocks. Other layers, on the contrary, do not suffer water to enter into them; such as clay, or gravel with much clay mixed with it, and rocks of a close or compact nature, without any fissures or clefts in them.

It is next to be remarked, that it is chiefly upon high mountains that water exists, or is formed, in very great

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Duration of hollow drains.

Drains when the wetness is caused by springs.

Nature of springs.

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great abundance. Not only do they catch and break the passing clouds, which deposit upon them the greatest portion of their watery contents, but they would seem to have a power, when neither rain nor clouds appear in the sky, of condensing, attracting, or somehow forming water from the atmosphere. In the great burning deserts of Africa rain is scarcely known. The inhabitants build their houses of clods of earth or of lumps of salt. A drizzling shower, which is apt to come once in several years, endangers every dwelling; and two hours of heavy rain would lay a whole city in ruins; yet even there, wherever mountains exist, that is to say, naked rocks, which abound in a few districts of this wilderness, water is almost always found in their vicinity; and, in consequence of the water, spots covered with the most luxuriant verdure are seen like islands amidst the dreary tracts of moveable and unproductive sand.

The upper part of mountains is very frequently covered with a layer of gravel, or loose and open rock, into which water readily penetrates. These porous layers or strata descend gradually into the bowels of the earth, and convey along with them the water which they contain, and have received from the clouds. Under the porous stratum or layer of gravel are usually layers of clay or of solid rock, through which the water cannot pass, but along the upper part of which it flows. After descending, however, a certain length obliquely down towards the plain country, layers or strata of clay and other impervious materials usually come to be placed above the layers of porous gravel. Thus, as the water in the gravel is confined between clay above and clay or rock below, and must descend along the gravelly channel which is pervious to it, streams of water are formed in the bowels of the earth, which have their origin in high gravelly soils, and their outlets at any place in the low country, where any part of the beds of gravel or porous rock, along which they flow, happens to approach the surface, forming springs and rivulets, and, by their union or conflux, mighty rivers, which continue steadily to water the surface of the earth. Hence also, in very many situations, by digging pits into the earth, we at last reach a layer of pervious gravel or rock, containing a stream of water, brought, perhaps, from the summit of a distant mountain; and such pits can be used as wells for supplying water for every domestic purpose.

We have said that the upper part of the face of a mountain is often covered with a bed of porous or gravelly substances capable of taking in water. Upon the surface, at a certain distance down the hill, a bed of clay begins. The water received above into the layer of gravel continues to descend with that layer for a considerable space below the bed of clay; and thereafter the gravel suddenly stops, and the clay above unites with the clay beneath, or with some other impervious strata upon which the gravel all the way rested. In this situation, as the water contained in the gravel can proceed no farther, it hangs within the side of the hill as in a bag of clay; and a reservoir is formed of water within the earth. When this bag or natural reservoir is full, the water contained in it is pressed upwards against the clay by which it is covered. It moistens this clay, and finds its way by chinks through all its weaker parts or pores. Thus a belt of

soft and spouty land is formed upon the side of the hill; the mode of draining which is very easy. If a hole is dug into the earth near the bottom of the bag or reservoir of water, so as to reach the layer of gravel, the water will instantly flow freely out, and, being no longer restrained, it will cease to press upon the layer or stratum of clay that covers it, or to force a passage through its chinks; and the soil will consequently be drained.

Let it be supposed, that the porous stratum or layer of gravel, instead of stopping on the side of a hill; descends into the plain or level country, the water all the while passing along in its bowels; and that the gravel has a layer of clay below and another layer of clay above it. After it has reached and passed to a considerable distance along the valley, if the layer of gravel either suddenly stop and allow the layers of clay to come together, or if the gravel have too little thickness and capacity to allow the water which flows within it to pass easily along, it will necessarily, from the new supplies of water which are continually descending, be pressed upwards against the layer of clay which covers it: as, in the former case, the clay will be softened, and the water will filtrate through all its weaker parts till it reach the surface, which it will keep constantly wet, and where it will stagnate in consequence of the flat and level form of the country. Over the softest places, a coarse verdure will spread, and the roots of the plants intertwining, will form shaking quagmires. In other places, the moss plants, being the only ones which can thrive in the moist and ungenial soil which is thus produced, will rapidly spring up, and a moss will be formed altogether unfit for any purpose of agriculture. To drain such a soil, it is evidently only necessary to dig a pit or hole through the upper stratum of clay into the gravel, to give a free vent or issue to the water; which having thus found an easy passage to the open air, will cease to press upon the incumbent layer of clay, or to render it moist. This clay will therefore speedily become dry and collapse; the moss plants will wither, provided the surface is properly drained; and the whole soil will become solid and fit to be cultivated.

It sometimes happens, as already noticed, that a piece of territory which lies low, is rendered extremely wet by rain and spring water coming from adjacent high grounds, and lodging upon its surface, while, at the same time, it is so completely surrounded by eminences, or land-locked, that it cannot be drained at a moderate cost; the consequence of which is, that the water stagnates, and a moss or bog is formed. The principles which we have already stated concerning the manner in which the globe is made up of various strata, indicate the way in which such a bog may be drained at a cheap rate. It is only necessary to dig a pit at the lowest part of it, down through the clay, or other impervious layer that holds up the water, till a porous stratum is reached, capable of conveying away the surface water down the country below ground to the sea, or to such rivers as it may chance to be connected with.

The whole art of draining land, where the wetness is occasioned by water pressing upwards from the bowels of the earth, depends upon these principles. It is an art whose importance is not yet sufficiently appreciated, because imperfectly understood, and because it

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Principle
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It has not yet been carried into practice to its full extent. It is probable, however, that at no remote period it will be held in universal estimation, on account of the command of those hidden streams that are contained in the bowels of the earth, which it will give to mankind for the purposes of an improved agriculture, and for the service of commerce in filling canals and giving motion to every kind of machinery. A dispute exists about the original discoverer of this art. The celebrated writer upon agriculture, Dr James Anderson of Aberdeen, in his "Essays on Agriculture and Rural Affairs," published in 1775, was undoubtedly the first person who explained to the world the nature of the art of draining land rendered wet by springs, and the principles upon which it ought to proceed; having been led to the investigation many years before, by his having fortunately succeeded in draining a bog by sinking a pit in it through the clay, till an opening was made into the gravel or porous stratum, from which the water rushed up vehemently. In the mean while, it had happened that Mr Joseph Elkington, possessor of a farm in England called Princethorpe, in the parish of Stretton upon Dunsmore, and county of Warwick, almost as early as Dr Anderson, had accidentally discovered that land might be drained in many situations by making a small hole into the earth. Being a man of considerable natural ingenuity, though, it is said, of little literature, he had the address to take advantage of the discovery he had made, with a view to the improvement of his affairs. He therefore commenced the trade of a drainer of lands; and by the novelty of draining land by a small hole bored often at a considerable distance from the wettest part of it, and by conducting himself in a mysterious manner, he acquired great reputation, and was extensively employed. This employment he appears to have merited, as his operations were attended with very great success. After the establishment of the Board of Agriculture, its members, who appear to have been unacquainted with Dr Anderson's publication, supposed Mr Elkington to be the only discoverer and possessor of the art of draining land wet by springs in the way now mentioned; and upon their recommendation, parliament bestowed a reward of 1000*l.* upon him. It was surely an unfortunate circumstance, that the first premium granted upon the recommendation of this board, should have proceeded upon an error, as it undoubtedly did; for, although Mr Elkington had the merit of being the first who introduced this art extensively into practice, there is no doubt that Dr Anderson, by whom also it was discovered, was the first who explained its principles to the public, and that at a period when Mr Elkington's secret remained with himself. After all, however, it is not to be supposed that the theory of this art was absolutely unknown, although these persons appear to have been the first who proposed to apply it extensively to the purposes of agriculture. It is said that the practice is very ancient in Italy, when a well is dug, to avoid the expence of going to a great depth, by boring with an auger in the bottom of the pit, in the hopes of reaching the porous stratum which contains the water. And in Germany it appears, as will be afterwards noticed, that the practice has long existed of draining land-locked bogs, by letting down the water by means of a

pit through the impervious clay, to a porous substratum. We shall now proceed to state the most approved modes of draining land that is rendered wet by springs, or water ascending out of the earth; and as the Board of Agriculture instructed Mr John Johnston, land surveyor, to inspect Mr Elkington's principal drainings of this sort, and to give an account of them, we shall give all due attention to the contents of the report made out by that gentleman, which is understood to have been executed with much fidelity and accuracy; though we shall also exhibit, at the same time, the practice of other intelligent persons upon the same subject.

In the practice of this art it will readily occur, ¹⁷⁵ Practical that it is of the utmost importance to obtain a knowledge of the internal structure of the earth, and of the manner in which its various layers or strata succeed, and are usually intermingled with each other. This object, however, can only be attained in any considerable degree of perfection by observation and experience. There are several ways, however, by which a man of sagacity and reflection may greatly abridge the difficulty of this study, so as in a short time to enable himself to practise the art of draining with considerable success. The surest way of ascertaining the inclination of the different strata, or the way in which they lie upon each other, and the direction in which they descend into the earth, consists of examining the bed of the nearest rivers, and the appearance of their banks when steep and broken, so as to lay bare the different strata of earth adjoining to them. Pits, quarries, and wells, that may have been dug in the neighbourhood; may also be examined with the same view. Rushes, small elder bushes, and other plants which grow on the wettest soils, also frequently afford symptoms of the line under which an internal reservoir of water is placed, and is pressing upwards from wanting a free passage below ground.

It is often of much importance, even in sheep countries, to drain the side of a hill, not only because ¹⁷⁶ To drain the side of land is more unproductive than that which is properly a hill. drained, but because the superabundance of moisture is apt to introduce and to keep up among the flock that destructive and incurable disease, the rot, for which draining is an almost infallible preventive. It is cheaply executed in such situations, because the drains for collecting and leading off the water, may usually be left uncovered. Let it be supposed then, that in consequence of internal springs at a certain distance down the declivity of a hill, or upon any other descending surface, the ground becomes wet and spouty, and unwholesome for sheep, and unfit for agriculture; the best mode of proceeding with a view to drain it is this. It ought to be recollected, that the reason of the wetness is this: The rain water at the summit of the high ground is received into a porous stratum of gravel, with which it descends down the side of the hill; till it comes to be covered with a clayey soil. After descending under the covering of clay to some distance, the gravel or porous under soil suddenly ceases; the clay becomes deeper, and touches the rock or another inferior bed of clay. In this situation, the water, unable to descend farther, regorges and presses upwards upon the clayey soil which covers it, rendering it moist and swampy in every part, and oozing through all its weaker

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weaker crannies. Thus it forms a belt of moist ground along the face of the hill, from which the water perhaps descends and damages every part. To drain this declivity, begin at the bottom and carry up a ditch towards the wet ground. As the object is to let out the water at the lowest point of the reservoir or natural bag in which it is contained, by making an opening into the gravel there, it will be proper, as the ditch proceeds upwards, frequently to bore holes with an auger of about two inches diameter to a considerable depth, that is, about 15 feet, though sometimes it is necessary to go to twice that depth. As long as the water is not found by boring, the ditch must be carried upwards, and new auger holes formed; when at last the auger by boring reaches the lowest part of the gravel or reservoir of water, the water will immediately rush forth with considerable violence at the hole formed by it, and will continue ever after to run without any danger of choking up. When the bottom of the reservoir of water or layer of gravel is thus found, another ditch ought to be drawn across the head of the former along the face of the hill, so as to form the figure of the letter T. In the upper ditch or drain that runs along the face of the hill, auger holes ought to be bored at short distances, to let out the whole water from the interior reservoir or stratum of gravel.

Plate XII.

The whole process will be easily understood from considering the figure 3. Care ought always to be taken in digging the upper drain along the face of the hill, to form it in such a way as that the water may descend in it towards the ditch first formed, which is intended to convey it down the hill to the nearest brook. The old practice or mode of draining ground in this situation before the use of the auger was understood, and before men had reflected upon the way in which water is often confined in the earth, consisted of digging a trench wherever the spouty land commenced. As this was not deep enough to reach the level, that is, to penetrate to the reservoir of water, it produced only a partial remedy. Other parallel ditches of the same kind were therefore cut the whole way down the declivity, and being filled with loose stones and connected with a descending ditch, each carried off only a portion of surface water, leaving the soil still cold in consequence of the wetness of the bottom.

In performing the operation already described, some difficulties are apt to occur, in consequence of the irregularities with which the strata are often placed in the earth. In boring in the ascending trench, in the first part of the operation, with a view to discover the lowest point at which the water may be let out from the interior reservoir, the operator is sometimes apt to be misled by finding water before he has come high enough to reach the place at which the porous stratum stops. This arises from its sometimes happening that at the bottom of the reservoir small leakages occur, and a portion of the water finds its way downwards through crannies in the earth to some distance from the main reservoir. When the auger in boring meets these leakages, they are apt to be mistaken for the main body of water, and the operator can only guard himself against such errors, by forming an estimate of the quantity of water which the adjoining high grounds ought to afford. If the quantity of water that follows the auger be very trifling, while the extent of high ground is great, he may be as-

sured that he has not yet reached the great cause of the wetness of the soil. It also sometimes happens that the cross drain carried along the face of the hill may in some places be below the level of the reservoir of water, while it is upon it at other places. In this case, when the auger by boring in the cross trench brings no water, it will be necessary to bore above it, and to conduct the water that is there obtained by a small cut into the general cross trench.

It sometimes happens that hills are composed of alternate strata of rock and sand and clay, which rest horizontally or nearly so upon each other, and penetrate and form the mass of the hill. In such cases the soil above the sand or rock is often dry and productive, while the clay is wet and swampy. In this case, the highest part of the hill being generally porous, receives the rain water, which descends through it till it meets the impervious clay, which forces it to flow to the surface, which it renders wet. Having overflowed the upper clay surface, it is immediately absorbed by the next porous stratum; and descending into it in like manner, again issues at the lower side of it, and injures the surface of the next bed of clay, as it did that of the first. To drain a hill side of this description, it is necessary to make a trench along the upper side of every belt of rushy or boggy soil to receive the water from the superior porous soil, and to lead the whole water thus obtained by one or more ditches downwards to the bottom.

Where a soil is composed of intermixed varieties, with clay predominating, it is sometimes very difficult to drain, as it is apt to form itself into a variety of hollow reservoirs, each of which holds water like a cup, while, at the same time, these hollows being full of porous materials, the surface of the soil is sufficiently regular. Thus in wet seasons, patches of moist unwholesome soil are formed, not by springs for which they may be mistaken, but by rain water held up by clay in these disjointed cavities. They can only be drained by separate covered cuts, communicating in the shortest way possible with one or more main drains.

With regard to the drainage of bogs, it has already been remarked, that they are either such as can have their water carried off by a communication, at a tolerable expence, with some adjoining lower ground; or they are land-locked, so as not to admit of being drained in this way. With regard to the former, or those which can be drained by trenches for conducting the water to an adjoining low country or river, they may be rendered wet by springs oozing out of the adjoining higher ground, in a regular line along the upper side of the wet surface, which afford water that stagnates upon the surface of the inferior ground, forming it into a bog. To render free from water a bog of this kind, nothing more is necessary than merely to drain the upper adjoining swampy ground in the way that has been already stated, and to convey away to a distance the water produced by it, in regular, open, or hollow drains.—The second class of bogs rendered wet by springs, consists of those in which the many springs that appear are not confined to one regular direction along the upper side, but burst out everywhere, forming shaking quagmires, over which it is dangerous for cattle to pass. The upper part of such bogs usually consists of peat-earth. Below that is found

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found a bed of clay, extremely wet and soft, through the crannies of which small quantities of water are continually oozing. When the lowest part of such a bog is found, or the place in which it will be most convenient to convey away the water, little more is usually necessary than to dig proper trenches, and to bore with the auger through the stratum of clay to the porous stratum containing the water. To drain an extensive bog, it will usually be necessary to dig a trench from end to end of it, with cross trenches at considerable distances, the bottom of the whole being frequently penetrated with the auger, so as to allow a free passage for the water to ascend; the effect of which will be, that the nature of the surrounding soft soil will speedily be altered, in consequence of the water being removed from beneath it. It will become dry and solid, and soon fit for bearing the plough. The same effect would follow, although only a single perforation were made through the inferior stratum of the bog; and accordingly Mr Elkington is said sometimes to have succeeded, while he drained a bog, in raising the water from it considerably above its own level, for any purpose for which it might be required. This was done by rearing around the perforation, a building of brick, puddled around and within with clay, to the top of which the water rose, and was from thence conveyed away in pipes or otherwise.

That the whole of this important subject, of draining land rendered wet by springs, may be better understood, we shall give an account of it as described by Dr Anderson, in his Essays published in 1775, already mentioned. Supposing, says he, a descending stratum of sand or gravel should be discontinued, and that the stratum above it should be of a coherent clayey nature; in this case, the water being pent in on every side, and being accumulated in great quantities, must at length force a passage for itself in some way, and pressing strongly upon the upper surface, if any one part is weaker than the rest, it would burst forth, and form a spring: but if the texture of every part of this stratum were equally strong, the water would squeeze through many small crannies, and would ooze out in numberless places, so as to occasion that kind of wetness that is known by the name of spouting clayey soil.

The cure in this case is easily effected.—For if a ditch of a considerable size is opened towards the lowermost part of the spouting ground, so deep as to penetrate through the upper stratum of clay, and reach to the gravel, the water will rise up through it at first with very great violence, which will gradually decrease as the pressure from the water behind is diminished; and when the whole of the water accumulated in the subterraneous reservoir is run off, there being no longer any pressure upon the clay above it, the whole soon becomes as dry as could be desired, and continues so ever afterwards, if the ditch is always kept open. This the doctor says he can assert from experience, having rendered some fields of this kind that were very wet quite dry by this method of treating them. The attentive observer, he adds, will readily perceive, that if any field that is wet from this cause admits of being ploughed, it will be in equal danger of being hurt by being raised into high ridges, with the other kind of damp ground before mentioned. For as the depth of earth above the reservoir would be smaller in the deep furrows than anywhere else, there would of consequence

be less resistance to the water in that place, so that it would arise there in greater abundance. And if, in this case, a farmer should dig a drain in each furrow, as a considerable quantity of water would rise into them, in some cases the ground might be improved, or even quite drained thereby, especially if they should have accidentally reached the gravel in any one place; although at an expence much greater than was necessary. “I take notice of this circumstance, says he, in some measure to prevent the prejudice that some inattentive observers might entertain against what was said before of this method of draining, from their having accidentally seen some fields that may have been bettered by it.

“Bogs are only a variety of this last-mentioned kind of wet ground; and therefore ought in general to be drained after the same manner with them. Clay is a substance that strongly resists the entrance of water into it; but when it is long drenched with it, it is, in process of time, in some measure dissolved thereby; loses its original firmness of texture and consistence; and becomes a sort of semi-fluid mass, which is called a *bog*; and as these are sometimes covered with a strong scurf of a particular kind of grass, with very matted roots, which is strong enough to bear a small weight without breaking, although it yields very much, it is in these circumstances called a *swaggle*. But, whatever be the nature of the bog, it is invariably occasioned by water being forced up through a bed of clay, as just now described, and dissolving or softening, if you will, a part thereof. I say only a part; because whatever may be the depth of the bog or swaggle, it generally has a partition of solid clay between it and the reservoir of water under it, from whence it originally proceeds: for if this were not the case, and the quantity of water were considerable, it would meet with no sufficient resistance from the bog, and would issue through it with violence, and carry the whole semi-fluid mass along with it. But this would more inevitably be the case, if there was a crust at the bottom of the bog, and if the crust should ever be broken, especially if the quantity of water under it were very considerable: and as it is probable, that, in many cases of this sort, the water slowly dissolves more and more of this under crust, I make no doubt but that, in the revolution of many ages, a great many eruptions of this kind may have happened, although they may not have been deemed of importance enough to have the history of them transmitted to posterity. Of this kind, although formed of a different substance, I consider the flow of the Solway moss in Northumberland to have been; which, upon the 16th of November 1771, burst its former boundaries, and poured forth a prodigious stream of semi-fluid matter, which in a short time covered several hundred acres of very fine arable ground. Nor will any one, who is acquainted with the nature of moss,—who knows its resemblance to clay in its quality of absorbing and retaining water, and its very easy diffusibility therein, be surprised at this; as from all these properties, it is much better adapted for forming an extensive bog, and therefore in greater danger of producing an extensive devastation by an irruption of the water into it, than those that are formed of any kind of clay whatever.

“If the bog, or swampy ground, is upon a declivity, the ditch ought to be carried across the field about the

Preparation of Land. the place where the lowest springs arise. But if the surface of the ground is level or nearly so, so as to form soft quagmires, interspersed through the whole of the field, it will be of little consequence in what part the drain is opened; for if it is dug up so deep as to allow the water to rise in it with freedom, it will issue through that opening, and the field will be left perfectly dry.

"But as it may frequently happen that the stratum of gravel should be at a considerable depth beneath the surface of the earth, and as it may be sometimes even below the level of the place into which the drain must be emptied, it might sometimes be extremely difficult to make a ditch so deep as to reach the bed of sand or gravel. But it is lucky for us that this is not absolutely necessary in the present case; as a drain of two or three feet deep, will be equally effectual with one that should go to the gravel. All that is necessary, in this case, is to sink pits in the course of the drain, at a moderate distance from one another, which go so deep as to reach the gravel; for as the water there meets with no resistance, it readily flows out at these openings, and is carried off by the drain without being forced up through the earth; so that the ground is left entirely dry ever after.

"I have likewise drained several fields in this way: and as I have generally found the appearances pretty much alike, I shall, for the information of the inexperienced reader, give a short account of them.

"If you attempt to make your pit in one of these soft quaggy places where the water is found in great abundance, you will meet with very great difficulty in forming it; for as the substance of which it is composed is soft, it will always flow into the hole as fast as you dig it; on which account I would advise, not to attempt to make the pit in the swaggle, but as near it in the solid earth as you conveniently can. However, if it is pretty firm, and of no great extent, it is sometimes practicable to make a pit in the soft bog at the driest time of the year. This I have sometimes practised, which gave me an opportunity of observing the nature of these bogs more perfectly than I otherwise would have had. In the trials of this kind that I have made, this soft quaggy ground has seldom been above three or four feet deep; below which I have always found a stratum of hard tough clay usually mixed with stones, and so firm that nothing but a mattock or pickaxe could penetrate it: and as this is comparatively so much drier than the ground above it, an inexperienced operator is very apt to imagine that this is the bottom that he is in search of. In digging through this stratum, you will frequently meet with small springs oozing out in all directions; some of them that might fill the tube of a small quill, and others so small as to be scarce perceptible: but without regarding these, you must continue to dig on without intermission till you come to the main body of the reservoir, if I may so call it, that is contained in the rock, gravel, or sand; which you will generally find from two to four feet below the bottom of the swaggle, and which you will be in no danger of mistaking when you come to it: for, if there has been no opening made before that in the field, as soon as you break the crust immediately above the gravel or rock, the water bursts forth like a torrent, and on some occasions rises like a *jet d'eau*,

to a considerable height above the bottom of the ditch; and continues to flow off with great impetuosity for some time, till the pent-up water being drained off, the violent boiling up begins to subside, and the strength of the current to abate, and, in a short time, it flows gently out like any ordinary spring;—allowing it to remain in this state, the quaggy earth begins to subside, and gradually becomes firmer and firmer every day; so that, in the space of a few months, those bogs which were formerly so soft as hardly to support the weight of a small dog, become so firm that oxen and horses may tread upon them without any danger of sinking, at the very wettest season of the year. I have had a field of this nature, that, by having only one such pit as I have now described opened in it, was entirely drained to the distance of above a hundred yards around it in every direction. But as it is possible that the stratum in which the water runs may be in some places interrupted, it will be in general expedient to make several of these pits, if the field is of great extent: always carrying the drain forward through the lowermost part of the field, or as near the quag as you conveniently can; and sinking a pit wherever you may judge it will be most necessary. But if the stratum of gravel is not interrupted, there will be no violent burst of water at opening any of these after the first, as I have frequently experienced. To keep these wells from closing up after they are made, it is always expedient to fill them up with small stones immediately after they are made, which ought to rise to the height of the bottom of the drain.

"I have often imagined that the expence of digging these pits might be saved by boring a hole through this solid stratum of clay with a large wimble made on purpose; but as I never experienced this, I cannot say whether or not it would answer the desired end exactly.

"If the whole field that is to be drained consists of one extensive bog, it will require a long time before the whole work can be entirely finished, as it will be impossible to open a drain through it till one part of it is first drained and become solid ground. In a situation of this kind, the undertaker, after having opened a drain to convey the water from the lowest part of the bog, must approach as near to the swampy ground as he can, and there make his first pit; which will draw off the water from the nearest parts of the bog. When this has continued open for some time, and that part of the bog is become so solid as to admit of being worked, let him continue the ditch as far forward through it as the situation it is in will admit of, and there sink another pit; and proceed gradually forward in the same manner; making cross cuts where necessary, till the whole be finished.

"In this manner may any bog or tract of spouting ground of this nature be rendered dry at a very inconsiderable expence; and as there can be no other method of draining ground of this sort effectually, I recommend the study of it to the attention of every diligent farmer who may have occasion for it. Let him first be extremely cautious in examining all the circumstances of his particular fields, that he may be certain which of the classes above enumerated it may be ranked with; and when he is perfectly sure of that, he may proceed without fear, being morally certain of success."

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M Wedge's
method of
draining.

We shall add the substance of a paper on this subject, for which the author received the silver medal of the Society instituted for the encouragement of Arts, Manufactures, and Commerce. That author is Mr John Wedge of Bickenhill, near Coventry, who is not only a great farmer himself, but had likewise been employed by the earl of Aylesford in the management of several estates. Encouraged by his lordship's liberality, Mr Wedge informs the society, that he had been employed for some years in draining large portions of land, of which part was in the earl's occupation, and part in his own, as tenant to his lordship. The principles upon which he proceeded, as well as his mode of procedure, he states in the following terms:

In every country there are large portions of land that, in wet seasons, have always what may be called a *dry surface*, and other portions of land that have always a *moist or wet surface*: the former of these admitting all the water which falls upon them to sink freely through their pores to various depths, till falling on clay, or some other unctuous earth, whose pores will not permit it to pass through, it is there held up to a height proportioned to the quantity of water which comes upon it, and the facility with which that water is discharged. Thus, held up to various heights, it serves as a fountain to distribute its water (either by veins of sand, pebbles, or rock, according to the formation of the different under strata) on the neighbouring lands; and there forms bogs and other varieties of wet surface, on a basis that will be always found to consist of marl or clay, or some mixture thereof. The effect of water thus distributed may be divided into two classes. The first class, where the water is thrown out by a body of marl or clay, &c. upon the surface of descending ground, and in the valley (there held up by clay also) forms bogs or swamps. The second class, where the water is held up by marl or clay, as before, having above that marl or clay a stratum of sand, or pebbles, through which the water passes; and above those sands or pebbles another stratum of marl or clay, through the weakest parts of which the water, by a continual pressure from its fountain, forces a passage upwards; and thus, through the weakest parts of the marl or clay furnishes a continual supply of water on the surface, for the formation or growth of bogs, &c. in proportion as this water is more or less abundantly supplied by its fountain or head, namely, the higher lands, into which rain-water freely passes, as before described. There are also different soils, under different circumstances, which may form a third class of land for draining; such as strong deep soils, or open light soils, having near the surface a body of marl or clay. In either of these cases, the water which falls on the surface must, for reasons which are self-evident, keep such lands, in rainy seasons, constantly wet and cold; and it should be observed, that a mixture of all the three before-described classes of wet land sometimes occurs in one field, by sudden alterations of the under strata, and thereby perplexes the operator, by requiring all the different modes of draining in the same field.

If it be admitted that bogs are thus formed and fed, their cure may be effected with certainty: The first class, by cutting through the stratum (be it sand, pebbles, or rock), that conveys the water to the bog, and carrying off that water by a close drain to some proper

place, where the level admits of its discharge: The second class, by sinking a drain to any convenient depth in the upper clay; and then digging or boring with a large auger, at a small distance on one side of this drain, through the remaining part, be it (the upper clay) ever so deep, into the under stratum of sand, pebbles, or rock, through which the water passes; which will then rush up into the drain so made, with a velocity proportioned to the height of the land or fountain whence it is supplied. As this drain advances through the land, holes must be dug or bored, as before, every seven yards, or at such distance as the strength of the springs may require; and the whole of the water thus brought up by tapping the springs, is carried off by the drain made in the upper clay, which must be a close one, to its proper level, and there discharged.

By both these methods of draining, large tracts of land, under favourable circumstances, may be cured with one drain. The best place for fixing these drains is where the stratum that conveys the water comes nearest to the surface; and the best method of ascertaining that is to bore or dig in different parts through the different under strata.

The third class may be easily cured by close drains, at such distances and depths as will best carry off the surface-water. It may not be improper to observe, that where the different strata or measures crop out, that is, become gradually more and more shallow in some certain direction (as is often the case, till, one after the other, they all present themselves in succession on the surface of the earth), draining may often be much more easily and better effected by crossing with the drain the different strata or measures, where the levels and other circumstances will admit.

Some of the land drained was part of a common, in the parish of Church Bickenhill, in the county of Warwick; part of it was covered with moss and ling, had a peaty surface, about six inches deep, and produced little or no grass: in all wet seasons it was filled quite to the surface, and often overflowed, with water. Some of the land was much more unsound, deeper of peat, and covered with moss, in most parts nine inches long; another part was an absolute bog in all seasons.

Having dug or bored with a large auger into several parts of the land, Mr Wedge found peat, gravel, and sand mixed, and a quicksand almost uniformly. The quicksand in every part, after getting an inch or two into it, seemed almost as fluid as water. Judging from this, that no materials for a drain could be laid in the quicksand, but what it would immediately bury, he dug a trench almost to the quicksand, leaving gravel, &c. of sufficient strength to bear up the materials for a hollow drain; these materials were two sides and a cover of stone, with a peat-turf on the top to keep out the soil. At every seven yards forward, by the side of this drain, he dug a hole in the quicksand as deep as it would permit. From these holes the water rose freely into the hollow drain, and was by it discharged at a proper level. It may be proper to remark, that the stone made use of for this drain, and all others here mentioned, was a red sand and rag-stone, which easily split into proper sizes for the purpose, and is very durable; it cost about sixpence per ton getting, exclusive of carriage. The drain thus formed ran on the whole rather freely, and made the land dry for a few yards on

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each side thereof, but was far from having the effect he improperly expected; for it evidently appears that the drain could only take a very small portion of the water from so large a quicksand, which it did not penetrate more than two inches; and that it could drain only to its own depth, or, at most, to that depth in the fountain which supplied the quicksand. His purpose was then defeated; and his motive for mentioning this error cannot, he hopes, be mistaken.

He now did what he says he ought to have done before, that is, he examined the different strata to a greater depth, particularly on the bog, and at the upper edges thereof, and found the bog to be what has been described under the first class. He therefore determined to attempt the cure in the manner before prescribed for that class, namely, to cut through the whole of the stratum (in this instance, of quicksand), through which he found the water pass. This he effected as follows: The summer being dry, and favourable for the purpose, and having previously made his main open drain, he began his main close drain the first week in June 1791, three feet wide, on the declivity near the edge of the great bog. In the first operation he dug through the peat, the hard sand, and gravel, and one spade's graft (about nine inches deep and seven inches wide) into the quicksand, the whole length of this drain, which was 73 perches, of eight yards to the perch, in length. The drain thus dug ran copiously, not less than 60 gallons per minute. In this state he left it about nine days: the effect of it was rapid, both above the drain and on the bog below. Upon examination, he now found about three inches on the top of the spade's graft, which had been made into the quicksand, perfectly dry. He then dug out these three inches of dry sand, to nearly the whole width of the drain, three feet; and at the same time dug out, as before, another spade's graft, from the top of the quicksand, as near the middle of the drain as possible. This was left to run a few days, as before, and had the same effect, namely, three or four inches more of the top of the quicksand became dry and hard. The same operation was repeated again and again with the same effect, till the purpose of getting through this quicksand was completed, so far at least as the level of the main open drain would permit. The stream of water continued increasing during the whole operation; the bog below the drain was quite dry, and the land above perfectly so. The drain which was first made, and continued running for some time during the progress of the main close drain, became gradually dry; and has not, since that drain was finished, discharged one single drop of water. Great care was necessary, in making the main close drain, to keep the stream of water in the middle of it, otherwise the current would have undermined the sides, as it sometimes had done, and caused them to fall in. For this reason it was necessary, when the dry sand was taken from the top of the quicksand, immediately to take out a spade's graft from the middle thereof, in order to divert the current from the sides.

The main close drain thus made was three feet wide at top, about nine feet deep on the average, and, beveling a little from the top, it was about one foot ten inches wide at the bottom. The stone and other materials were put into this drain in the following manner:

1. Where the drain went through the quicksand into

the stratum of clay below it, as in most places it did, the bottom, and in some instances the sides, wanted no particular security; but where it did not go quite through the quicksand, which the level of his main open drain in some places would not admit, the bottom of the drain was covered half an inch thick with ling; then peat turfs, one foot wide and three or four inches thick, were cut in convenient lengths, and placed on their edges on each side of the bottom of the drain, forming two sides of a trough of peat; then side stones about eight inches high and a stone coverer, were put in upon the ling between the peat turfs; a large peat-turf, near two feet wide and four inches thick, was then cut and firmly placed over the whole: this left in the bottom of the drain an open space, of more than six inches square, for the water to pass. The whole was then completed by filling in the upper part of the drain.

In this way the author drained for about 80l. thirty acres of land, which, from being of no value whatever, became worth at least 14 shillings per acre of yearly rent. He likewise hollow-drained nine acres by the method prescribed for the third class of wet land. These drains were made a few yards below that part of each field where the dry and wet land separate, about 22 inches deep, with sides and a coverer of stone, and ling on the top of it, to keep the earth from running in. The length of these drains was 880 yards, and the expence of labour and materials three halfpence per yard. The drains, in wet weather, discharge a large quantity of water; and will, he has no doubt, answer the intended purpose. Thus far relates to land in his own occupation.

Nine acres of the land in the earl of Aylesford's occupation was almost an entire pulp. This bog was of the second class, namely, water passing through a quicksand, and confined by a stratum of clay below, and another stratum of clay above it. The water thus confined, being pressed by its fountain, and forced up through the weakest parts of the clay, had formed a bog of irregular thickness on the surface, in some places six feet deep, in others not more than two. As there is a considerable fall in this land from east to west, he thought it expedient to put two drains into it; and this appears to him to have been necessary, from a consideration that both these drains continue to run in the same proportions as when first opened. The manner in which these drains were executed was, by digging through the different upper strata, and as deep into the clay as the main open drain would admit: then digging or boring through the remaining part of that clay into the quicksand, at the distance of about six yards, in a progressive manner.

The water rising rapidly through these holes into the close drains, has effected a complete cure of this land, every part of which will now bear a horse to gallop upon it. These drains discharge 3660 gallons an hour; which is much less than they did at first, as must be the case in all bogs. This land will be worth 20s. per acre. The draining cost 25l.; and the length of the under-ground drains is eight hundred and four-teen yards.

Mr Wedge had just finished (January 1792) draining another piece of land, about forty-three acres. As this was intended to answer two purposes, one, to drain the

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About six acres of this land were always sound; about twelve acres on the north side were an absolute pulp, and the remaining twenty-six acres very unsound. The whole is now sound, and will, when cultivated, be worth 16s. per acre. This land would have been drained at a much less expence into the main open drain; but then the water, which was much wanted for the mill, would have been lost. These close drains are in length 1452 yards, and cost 100l. of which about 30l. ought to be charged to the mill.

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With regard to the drainage of land-locked bogs, which are often situated so much lower than the ground around them, that the cutting a main drain would cost more than the value of the land when drained; the mode of proceeding, with a view at once cheaply and effectually to relieve them from the superfluous moisture which renders them useless to agriculture, is the following: A spot in the middle or lowest part of the bog must be selected, towards which all the drains must be conducted, as radii to a common centre. When this central spot is properly cleared out to the top of the clay, or retentive substratum, which in this case must not be affected by water from below, but only by surface or rain-water, a number of perforations must be made with the auger, to give an outlet downwards for the water, which will be absorbed by the porous stratum below. A conduit should be formed over the auger holes, by loose stones, placed in such a manner as to prevent their being afterwards filled up by any rubbish: or rather auger holes may not be sufficient; and it may be a preferable plan to make a

large pit, or well, in the lowest part of the bog, dug through into the porous substrata. This pit ought to be filled with large stones, and the drains from the rest of the field conducted to that spot, as mentioned in the following quotation from the Agricultural Report of Hertfordshire.—“If a pit is sunk 20 or 30 feet deep in the middle of a field, through the Hertfordshire red, flinty, and impervious clay, into the chalk below; when the usual quantity of chalk is taken out, the pit shaft is filled up with the flint taken out of the chalk and clay, and the top drainage of this part of the field is much shortened for ever afterwards, by making principal drains from the part of the field above the level of the top of the pit terminate therein, as the superabundant moisture will escape through the flints in the pit shaft to the chalk below. And if a drain is carried into a limestone quarry, it is seldom necessary to carry it further.

“In dells or hollows, of considerable extent, covered with an impervious stratum, and from which there is no natural drainage, such as the valley between Mold, the shire-town of Flintshire, and the adjoining high land, a pit about four feet diameter, and 15 feet deep, more or less, as the case may require, is sunk through the impervious superstratum, into a pervious stratum of gravel, and the rain water, and that of some adjoining springs, are carried from the surface thereby; the pit is railed round to prevent cattle from falling into it. I must here remark, that though in this, as well as in many other instances that may be given, the top water escaped through the pervious substratum, the effect might have been directly the contrary. I therefore recommend the impervious superstratum, in all such cases, to be perforated by bore-rods, as the hole made by them is easily stopped up.”

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In Dr Nugent's travels through Germany, published German mode of
in 1768, a mode of draining marshes upon similar prin-
ciples is described, as having been practised in that
country. He had only seen it performed on moor
grounds, though it is also successful with regard to
lakes. “It is the nature, says he, of moors in general,
that beneath the turf or moss there is a loam which
hinders the moisture from penetrating; and this in-
deed is what makes the marsh, and causes the luxuri-
ant growth of the turf or moss; but this loam or clay
is only a stratum, and far from being of an immense
depth; under it is generally a sand, or some other stony
or loose soil.

“Here reason readily informs us, that a middling morass may be drained by perforating the clay, and thus making way for the moisture to penetrate. In order to this, a pit is dug in the deepest part of the moor, till they come below the obstructing clay, and meet with such a spongy stratum as, in all appearance, will be sufficient to imbibe the moisture of the marsh above it. Into this pit the ebbing of the morass is conveyed through a trench, and both the trench and the pit are filled up after the first drain with large broad stones, setting them edgewise, so as to leave interstices for carrying off the water; then such stones are laid over breadthwise, and these covered with loose earth like that on the surface: when no such stones are to be had, strong piles are rammed down the sides of the trench, and broad boards laid across; and these are covered with earth to a height fit for culture.

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This is a matter of no great expence, the pit being as near the morass as the water will admit, and the trenches but short; then they have a drain unperceived, which leaves the surface of the trenches for the plough; and in middling marshes, especially in such moors as are only wet and damp, this method, though sometimes slow, never fails taking effect; and many tracts are thereby made serviceable to the farmer or grazier."

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Draining in
Roxburgh-
shire.

The writer of the Roxburghshire Agricultural Report represents himself as having successfully adopted a similar mode of draining. In that part of the country, such of the waste lands, as are capable of being drained so as to become arable, have, at the distance of from one to six feet below the surface, a large stratum or seam of a black slaty or metallic substance, generally from 20 to 25 feet in thickness. Below this is a layer of whinstone rock of unknown depth. The black slaty or metallic substance has no chinks or fissures, and is impenetrable to water; but the whinstone rock beneath it abounds with chinks and fissures, and will swallow up any quantity of water poured into its bosom. The uppermost surface of the soil is of a light mossy nature, upon which the water stagnates in winter, so as to swell and enlarge it to a considerable degree. In the spring months, when dried by the sun and the wind, the moss becomes tolerably firm, and produces a coarse unprofitable grass, mixed with short heather; neither of which are of any value as food for sheep or cattle. In the year 1784 the writer of the Report ploughed up 20 acres of the waste lands of the above description, a part of them being situated on a level. This last part was gathered into small ridges, and ploughed pretty deep, and the stones removed. Thus it lay till midsummer 1785; but, during the spring, the sheep and cattle were frequently driven upon it to tread it to a firm consistence. At midsummer it was gathered up again; and, to get the water out of the hollows of the ridges, a pair of boring rods were obtained, which were put down through the slaty substance to the whinstone rock at sundry places. This effectually answered the purpose. The tops of the holes were kept open with baskets of loose stones over them, which were allowed to remain or removed at pleasure, as the weather proved more or less wet. In spring 1786 the land was in a condition to sow almost as early as any other part of the farm, the winter rains having found their way down into the whinstone rock through the slaty substance, and the land speedily became and continued very valuable.

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Draining of
quarries and
mines.

We may here add, that the modes of draining now stated are also valuable for other purposes than those of agriculture. Quarries, for example, and nail pits may often be cleared of water, by cutting off the springs by which they are incommoded, or by letting down the water into the next porous stratum. The same may be often done, with regard to deep mines, the working of which may frequently be thus greatly facilitated. A colliery for example, in Yorkshire had been wrought for several years, and the water was raised from it about 60 yards by a steam engine. The proprietors having bored about ten yards farther, to ascertain the thickness of a seam of coals; as soon as the boring rods were withdrawn, the water from the works, which usually ran across that place, began to sink into the holes made by the rods; and continuing to do so, the steam engine became useless, as its pump had no longer any water to draw. It must be observed, that the situation

was higher than the nearest valleys, or the level of the sea; but this example shows of what extensive importance a knowledge of the principles upon which the above modes of draining proceed may hereafter become.

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3. Of rendering MOSSES fit for CULTIVATION.

In many parts of the country a very serious obstruction to the cultivation of large portions of territory arises from the existence of mosses. It is, therefore, of much importance to consider their nature, and how they are to be rendered fertile.

With regard to the nature and origin of moss, the celebrated Dr Anderson, whose works we have already frequently quoted, advances this opinion, that moss is a vegetable, or an assemblage of vegetables, growing or living below, while at the top it is dead. Hence, he distinguishes moss into two kinds; quick moss, from which peats are dug, on which no vegetables grow, and in which no animals exist, while in its natural situation; and dead moss, which frequently covers the former, and upon which heath and fog and coarse grasses grow, and insects and other animals are found. Mr Headrick states various objections to this opinion, some of which appear to have great force. Thus, it is observed, that the moss here supposed to be alive below the soil, has every mark of utter deadness and partial dissolution. When tossed about in a very dark night, it emits light like half-rotten wood, giving rise to frequent terrors in those who live in the vicinity of peat bogs. It also seems a strange circumstance, and contrary to the whole analogy of nature, to suppose that a vegetable should grow, should form ligneous fibres, and acquire inflammability, without the influence of the sun, or contact with the air, during any period of its growth. The true history of the origin of mosses seems to be this: What are called the moss plants, amount to about three hundred in number. They are extremely hardy, and are capable of flourishing in the most cold and bleak situations, providing they only are surrounded by abundance of stagnating water. Accordingly, wherever water stagnates in a moderate quantity, they grow up, and, by spreading themselves around, they increase the stagnation. When they have arisen in this manner, with the water around them, to a considerable height, the lower parts of their stems being continually soaked or macerated in water, cease to vegetate, and give forth their juices to the surrounding fluid. As the moss plants are extremely astringent, and contain large quantities of the gallic acid and tanning principle, the moss water acquires these qualities, or becomes astringent, in a great degree, and prevents any process of putrefaction from taking place, or the stems of the moss plants from suffering any proper process of rottenness or chemical decomposition. Hence it is, that moss water has sometimes been used for tanning leather, in the same manner as the liquor of oak bark. In the mean time, while the stems of the moss plants remain in this manner dead, but prevented from rotting, or becoming the habitation of animals which cannot live in a vegetable astringent liquor, the tops of the plants that are at the surface of the water continue to grow, or new plants rise upon the summits of the dead ones, and continue their ascending progress; the whole being perhaps a sort of parasitical plants, which can grow upon each other.

In this way, a moss proceeds, rising higher and higher, till from the nature of the adjoining country, and the declivities

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declivities in it, the water cannot stagnate to any greater depth. After the moss has come to this height, its farther growth is prevented; its plants, unable to live or grow without abundance of water, wither and die; the upper part of them being exposed to the action of the air, suffers an ordinary process of decomposition, like other vegetable remains, and is converted into a sort of soil, upon which a few plants and reptiles are sometimes found; while at a small depth, that is to say, below the surface of the stagnating water, the whole stems of the ancient moss plants continue macerated in their own liquor, and preserved from putrefaction by it.

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There are, however, two general kinds of mosses; black moss, and whitish or yellow moss. The black moss is originally of a mahogany colour, but speedily becomes black upon exposure to the air. The yellowish, or foggy moss, is much less compact than the former, and retains a light or yellowish colour after it is dried. It does not appear to be in such a perfect state of maceration as the black moss, has less variety of plants, and is never so solid. It is usually produced in low warm situations, and appears to have grown rapidly; whereas, the black moss is most commonly found in cold elevated lands, and seems to have consisted of a greater number of less luxuriant plants. Thus, moss may be regarded as bearing some resemblance to timber, which is always of a compact grain, and close texture, in proportion to the severity of the climate of which it is the product, or rather in proportion to the length of time which it has taken to grow.

From what has been here stated, it will not be difficult to understand the mode in which mosses come originally to find an existence, or to cover a piece of territory in any country. When a pool of water is speedily, or in a short time, formed to a great depth, no moss appears; but when a gradual stagnation to a small depth takes place, upon any spot, especially in a cold and exposed situation, there the moss plants (being the only ones capable of subsisting on such a soil) speedily grow up, and occupy the place of every other. Though the quantity of water that originally stagnated there might not be great, it is increased by degrees, in consequence of the additional obstruction produced by the roots, stems, and leaves of the moss plants, till at last it forms a bog of very great depth.—We have already mentioned the nature and cause of the stagnation of water. It may either occur in consequence of the figure and quality of the soil making it tenaciously to retain the falling rains, or it may be the consequence of springs or reservoirs of water pent up or confined in the bowels of the earth by an incumbent mass of clay. Struggling to rise up through this clay, it will wet every part of it, and will slowly ooze through all its less adhesive parts, and will form a soil fit only for the reception of moss plants, which will there, by obstructing the departure of the moisture, which is constantly rising, in the course of years rear up the surface into a complete and perfect peat-hog.

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But mosses not only arise in particular situations, in consequence of these operations of nature: They are also produced as the result of certain exertions of human industry. In almost all our mosses in this country great numbers of trees of various sorts are found. They remain, like the inferior parts or roots of moss plants, infused and macerated in the moss water, but not rotted. The

trees and shrubs found at the bottom of mosses in Scotland, exhibit, perhaps, the whole variety of the native trees and shrubs. Of trees, are found the oak, the elm, the birch, the willow, the alder, and fir. Of shrubs, we find the hazel, the dwarf willow, the gall plant, and lastly, the heath plant. This last is of so hardy a nature, that it often continues to rise upon the moss during the whole period of its existence. Now, if it should be supposed, that at any time extensive forests of these trees were suddenly cut down by the exertions of man, they would undoubtedly produce a stagnation of water, and a bleakness of climate, that would render the situation fit only to be inhabited by moss plants, which would therefore speedily rise up, and form a peat-bog, in which multitudes of trees and shrubs would be found soaked in their own juice, and in the astringent liquor resulting from the maceration of the stems of the moss plants. That in ancient times old forests were thus destroyed by the efforts of man, we have every reason to believe. Not only in this country, but also in England and Ireland, there are found in mosses vast numbers of trees standing with their stumps erect, and their roots piercing the ground in a natural posture as when growing. Many of those trees are broken or cut off near the roots, and lie along, and this usually in a north-east direction. People who have been willing to account for this, have usually resolved it into the effect of the deluge in the days of Noah; but this is a very wild conjecture, and is proved false by many unanswerable arguments. The waters of this deluge might indeed have washed together a great number of trees, and buried them under loads of earth; but then they would have lain irregularly and at random; whereas, in this case, the trees all lie lengthwise from south-west to north-east, and the roots all stand, in their natural perpendicular posture, as close as the roots of trees in a forest.

Besides, these trees are not all in their natural state, but many of them have the evident marks of human workmanship upon them, some being cut down with an axe; some split, and the wedges still remaining in them; some burnt in different parts, and some bored through with holes. These things are also proved to be of a later date than the deluge, by other matters found among them, such as utensils of ancient people and coins of the Roman emperors.

It appears from the whole, that all the trees which we find in this fossil state, originally grew in the very places where we now find them, and have only been thrown down and buried there, not brought from elsewhere. It may appear indeed an objection to this opinion, that most of these fossil trees are of the fir kind; and that Cæsar says expressly, that no firs grew in Britain in his time: but this is easily answered by observing that these trees, though of the fir kind, yet are not the species usually called the *fir*, but pitch tree; and Cæsar has nowhere said that pitch trees did not grow in England. Norway and Sweden yet abound with these trees; and there are at this time whole forests of them in many parts of Scotland, and a large number of them wild upon a hill at Wareton in Staffordshire to this day.

In Hatfield marsh, where such vast numbers of the fossil trees are now found, there has evidently once been a whole forest of them growing. The last of these was found alive, and growing in that place, within

Preparation within 70 years last past, and cut down for some com-
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It is also objected by some to the system of the fir growing where they are found fossil, that these countries are all bogs and moors, whereas these sorts of trees grow only in mountainous places. But this is founded on an error; for though in Norway and Sweden, and some other cold countries, the fir kinds all grow upon barren and dry rocky mountains, yet in warmer places they are found to thrive as well on wet plains. Such are found plentifully in Pomerania, Livonia, Courland, &c.; and in the west parts of New England there are vast numbers of fine stately trees of them in low grounds. The whole truth seems to be, that these trees love a sandy soil; and such as is found at the bottoms of all the mosses where these trees are found fossil. The roots of the fir kind are always found fixed in these; and those of oaks, where they are found fossil in this manner, are usually found fixed in clay: so that each kind of tree is always found rooted in the places where they stand in their proper soil; and there is no doubt to be made but that they originally grew there. When we have thus found that all the fossil trees we meet with once grew in the places where they are now buried, it is plain that in these places there were once noble forests, which have been destroyed at some time; and the question only remains how and by whom they were destroyed. This we have reason to believe, by the Roman coins found among them, was done by the people of that empire, and that at the time when they were established or establishing themselves here.

Their own historians tell us, that when their armies pursued the wild Britons, these people always sheltered themselves in the miry woods and low watery forests. Cæsar expressly says this; and observes, that Cassibelan and his Britons, after their defeat, passed the Thames, and fled into such low morasses and woods that there was no pursuing them: and we find that the Silures secured themselves in the same manner when attacked by Ostorius and Agricola. The same thing is recorded of Venutius king of the Brigantes, who fled to secure himself into the boggy forests of the midland part of this kingdom: and Herodian expressly says, that in the time of the Romans pushing their conquests in these islands, it was the custom of the Britons to secure themselves in the thick forests which grew in their boggy and wet places, and when opportunity offered, to issue out thence and fall upon the Romans. The consequence of all this was the destroying all these forests; the Romans finding themselves so plagued with parties of the natives issuing out upon them at times from the forests, that they gave orders for the cutting down and destroying all the forests in Britain which grew on boggy and wet grounds. These orders were punctually executed; and to this it is owing that at this day we can hardly be brought to believe that such forests ever grew with us as are now found buried.

The Roman histories all join in telling us, that when Suetonius Paulinus conquered Anglesea, he ordered all the woods to be cut down there, in the manner of the Roman generals in England: and Galen tells us, that the Romans, after their conquest in Britain, kept their soldiers constantly employed in cutting down forests, draining of marshes, and paving of bogs. Not

only the Roman soldiers were employed in this manner, but all the native Britons made captives in the wars were obliged to assist in it: and Dion Cassius tells us, that the emperor Severus lost no less than 50,000 men in a few years time in cutting down the woods and draining the bogs of this island. It is not to be wondered at, that such numbers executed the immense destruction which we find in these hurried forests. One of the greatest subterranean treasures of wood is that near Hatfield; and it is easy to prove, that these people, to whom this havock is thus attributed, were upon the spot where these trees now lie buried. The common road of the Romans out of the south into the north, was formerly from Lindum (Lincoln) to Segelochum (Little Burrow upon Trent), and from thence to Danum (Doncaster), where they kept a standing garrison of Crispinian horse. A little off on the east, and north-east of their road, between the two last-named towns, lay the borders of the greatest forest, which swarmed with wild Britons, who were continually making their sallies out, and their retreats into it again, intercepting their provisions, taking and destroying their carriages, killing their allies and passengers, and disturbing their garrisons. This at length so exasperated the Romans, that they were determined to destroy it; and to do this safely and effectually, they marched against it with a great army, and encamped on a great moor not far from Finningly: this is evident from their fortifications yet remaining.

There is a small town in the neighbourhood called *Osterfield*; and as the termination *field* seems to have been given only in remembrance of battles fought near the towns whose names ended with it, it is not improbable that a battle was fought here between all the Britons who inhabited this forest and the Roman troops under Ostorius. The Romans slew many of the Britons, and drove the rest back into this forest, which at that time overspread all this low country. On this the conquerors taking advantage of a strong south-west wind, set fire to the pitch-trees, of which this forest was principally composed; and when the greater part of the trees was thus destroyed, the Roman soldiers and captive Britons cut down the remainder, except a few large ones which they left standing as remembrances of the destruction of the rest. These single trees, however, could not stand long against the winds, and these falling into the rivers which ran through the country, interrupted their currents; and the water then overspreading the level country, made one great lake, and gave origin to the mosses or moory bogs, which were afterwards formed there, by the workings of the waters, the precipitation of earthy matter from them, and the putrefaction of rotten boughs and branches of trees, and the vast increase of water moss and other such plants which grow in prodigious abundance in all these sorts of places. Thus were these burnt and felled trees buried under a new formed spongy and watery earth, and afterwards found on the draining and digging through this earth again.

Hence it is not strange that Roman weapons and Roman coins are found among these buried trees; and hence it is that among the buried trees some are found burnt, some chopped and hewn; and hence also it is that the bodies of the trees all lie by their proper roots, and with their tops lying north-east, that is, in that direction

Preparation of Land. tion in which a south-west wind would have blown them down: hence also it is, that some of the trees are found with their roots lying flat, these being not cut or burned down, but blown up by the roots afterwards when left single; and it is not wonderful, that such trees as these should have continued to grow even after their fall, and shoot up branches from their sides which might easily grow into high trees. (*Phil. Trans.* N^o 275.)

By this system it is also easily explained why the moor soil in the country is in some places two or three yards thicker than in others, or higher than it was formerly, since the growing up of peat earth or bog ground composed of moss plants is well known, and the soil added by overflowing of waters is not a little.

As the Romans were the destroyers of this great and noble forest, so they were probably also of the several other ancient forests; the ruins of which furnish us with the bog wood of Staffordshire, Lancashire, Yorkshire, and other counties. But as the Romans were not much in Wales, in the isle of Man, or in Ireland, it is not to be supposed that forests cut down by these people gave origin to the fossil wood found there; but though they did not cut down these forests, others did; and the origin of the bog wood is the same with them and with us. Holinshead informs us, that Edward I. being not able to get at the Welsh because of their hiding themselves in boggy woods, gave orders at length that they should all be destroyed by fire and by the axe; and doubtless the roots and bodies of trees found in Pembrokeshire under ground, are the remains of the execution of this order. The fossil wood in the bogs of the island of Man is doubtless of the same origin, though we have not any accounts extant of the time or occasion of the forests there being destroyed; but as to the fossil trees of the bogs of Ireland, we are expressly told, that Henry II. when he conquered that country, ordered all the woods to be cut down that grew in the low parts of it, to secure his conquests, by cutting away the places of resort of the rebels.

The tendency of our climate to produce in cold and damp situations moss plants, which gradually form around themselves a liquor which is the enemy of all putrefaction, may be considered as a fortunate circumstance, upon the whole, for the preservation of the health of men and animals, as well as contributing to other valuable purposes. In considering the nature of moss, "I cannot dismiss the subject (says Mr Headrick) without suggesting my admiration at the beneficence of Providence, in having provided the moss plants for the situations in which they grow: they afford an immediate supply of fuel, and are the source from which pit coal derives its origin, though trees, and all the plants which abound in oils and carbon also contribute to the supply of pit coal. Were the places now occupied by mosses divested of vegetables, or stored with vegetables of a different character, they would become noisome fens, which, by the emission of putrid gasses, would spread all around them pestilence and death. Mosses emit no noxious gasses, but rather, by growing at the surface, where the plants are acted upon by the sun's rays, they perpetually throw out oxygen, and thus contribute to the salubrity of the atmosphere. The only effect with which they are chargeable is forming magazines of moisture, which by its exhalation

Preparation of Land. tion generates cold, and spreads rheumatism and intermitting fevers among all the animals within its reach. The perpetual evaporation of this moisture not only tends to chill the moss, but it descends in hoar-frost and mildews upon all the lands that are lower in point of situation. These last mentioned disadvantages are more than amply compensated by the consideration that moss is not only an inexhaustible magazine of manure for other soils, but may be converted into a most fertile soil itself. After it is so converted, none of the defects already stated are any longer applicable to it."

This gentleman analyzed chemically some specimens of moss. He found that a small portion of Berkshire peat, of great hardness, exhibited, when pounded in a mortar and infused in warm water, a liquor that had some slight marks of acidity by test paper. Gypsum and sulphat of magnesia appeared to exist in it. A purified potash produced an abundant precipitation of various substances. A portion of this peat being burned, gave forth at the close of the operation a sulphureous smell and flame. The white ashes, after some days, assumed a rusty colour, from iron contained in them. Being washed, the liquor appeared to contain sulphates of lime, magnesia, alumine, and iron. Black hard peat of Swinridgemuir, in Ayrshire, when burned, gave brown ashes which were attracted by the magnet. An infusion of them in water exhibited no mark of acid or of alkali, and the ingredients contained in it appeared to be the same as in the Berkshire peat. Foggy or yellow peat yielded a smaller quantity of ashes, which were white, and did not obey the magnet.

Moss water, obtained by squeezing light peats, contained gallic acid and tanning principle in great quantities. Quicklime appeared to be the most powerful agent in precipitating every substance from the moss water, and in rendering moss a compact and solid substance; a fact which, as will be afterwards noticed, has been successfully taken advantage of in practice.

There are two ways in which a tract of territory that is covered by moss may be reduced under the dominion of the plough, or rendered fit for the purposes of agriculture. The one consists of altogether removing the mossy substance, or the whole wrecks of the moss plants that have been accumulating for ages, and endeavouring thereafter to cultivate the subsoil. The other mode consists of converting the substance of the moss into vegetable mould fit for bearing crops of grain.

The first of these plans has been adopted with regard to the moss of Kincardine, and the other has been successfully practised by Mr Smith of Swinridgemuir, in Ayrshire; and in imitation of him by various other persons in different districts of the country. To each of these we shall give attention.

The moss of Kincardine is a remarkable tract of ground in the shire of Perth, in Scotland, which deserves particular notice, both as a topographical curiosity or subject of natural history, and for the information, equally uncommon and important, which it affords, respecting agricultural improvements, and the promotion of industry and population.

The moss of Kincardine is situated in the parish of the same name, comprehended between the rivers Forth and Teith, and in that district of Perthshire called *Monteith*. The moss begins about a mile above the confluence of these rivers; from thence it extends in length

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The moss of Kincardine removed by human labour.

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length about four miles, and from one to two in breadth; and before the commencement of the operations (an account of which is to be given), comprehended near 2000 Scots acres, of which about 1500 belong to the estate of Blair Drummond, the property of the late Lord Kames, by his marriage with Mrs Drummond of Blair Drummond.

As mosses are extremely various in their nature; before entering upon the improvements made in Kincardine moss, it will be proper to give a short description of that moss, and of the subjacent soil which is the object of these improvements.

The moss lies upon a field of clay, which is a continuation of those rich extensive flats in the neighbourhood of Falkirk and Stirling, distinguished by the name of *carses*. This clay, which is one uniform homogeneous mass sinking to a great depth, is found near the surface, consists of different colours, and is disposed in layers. The uppermost is gray; the next is reddish; and the lowest, which is the most fertile, is blue. Through the whole mass not a pebble is to be found. The only extraneous bodies it contains are sea-shells, which occur in all the varieties peculiar to the eastern coast of Scotland. They are disposed sometimes in beds, sometimes scattered irregularly at different depths. By attending to these circumstances, it cannot be doubted that the sea has been the means of the whole accumulation, and that it was carried on in a gradual manner by the ordinary ebb and flow of the tide. Upon any other supposition, why should there not have been a congeries of all the different materials that compose the surface of the surrounding heights? But to whatever cause the origin of this accumulation may be ascribed, certain it is that no soil whatever is more favourable to vegetation, or carries more abundant crops of every kind.

The surface of the clay, which, upon the retreat of the sea, had been left in an almost level plane, is everywhere thickly covered with trees, chiefly oak and birch, many of them of a great size. These trees seem to have been the first remarkable produce of the *carse*; and it is probable they were propagated by dissemination from the surrounding eminences. They are found lying in all directions beside their roots, which still continue firm in the ground in their natural position; and from impressions still visible, it is evident they have been cut with an axe or some similar instrument. For the cutting of wood, the two common purposes are, either to apply it to its proper use, or that the ground it occupies may be cultivated. In this present case, however, neither of these ends had been proposed, since the trees, by being just left as they were cut, were not only entirely lost, but the ground was rendered totally unfit for cultivation. Hence it is evident, that the downfall of this wood must be ascribed to some more extraordinary cause; and to none more probably than to that expedient, which, as we learn from Dion Cassius and other historians, the Romans put so extensively in practice to dislodge from their forests the ancient inhabitants of the British islands, as already explained.

This hypothesis acquires no small degree of force from a circumstance that occurred in May 1768, when a large round vessel of thin brass and curious workmanship, 25 inches in diameter, and 16 inches in height,

was discovered upon the surface of the clay buried under the moss. This vessel, found upon the estate of John Ramsay, Esq. of Ochertyre, was by that gentleman presented to the Antiquarian Society of Edinburgh; in whose museum it remains deposited for preservation. And in a list of the various donations presented to that society, published by them in 1782, it is there denominated a *Roman camp kettle*.

Between the clay and the moss is found a stratum nine inches thick, partly dark brown and partly of a colour approaching to black. This is a vegetable mould, accumulated probably by the plants that covered the ground previous to the growth of the wood, and by leaves from the trees thereafter. The difference of colour must be owing to a difference in the vegetable substances that compose it. The brown mould is highly fertile; the other, especially in a dry season, is very unproductive. The crop that had occupied this mould when the trees were felled is found still entire. It consists chiefly of heath; but several other smaller plants are also very distinguishable.

Immediately above this stratum lies the moss, to the height, upon an average, of seven feet. It is composed of different vegetables arranged in three distinct strata. Of these the first is three feet thick. It is black and heavy, and preferable to the others for the purpose of fuel. It consists of bent grass (*agrostis*), which seems to have grown up luxuriantly among the trees after they were felled. The second stratum also is three feet thick. It is composed of various kinds of mosses, but principally of bog-moss (*sphagnum*). It is of a sallow or iron colour, and remarkably elastic. It is commonly called *white peat*; and for fuel is considered as much inferior to that above mentioned. The third stratum is composed of heath and a little bent grass, but chiefly of the deciduous parts of the former. It is about a foot thick, and black.

By far the greatest part of the moss in question is, upon an average, full seven feet deep, and has in all probability lain undisturbed since its formation: this is called the *High Moss*. The remainder, called the *Low Moss*, lies to a considerable breadth around the extremities of the high; and is, upon an average, not above three feet in depth, to which it has been reduced by the digging of peats. These are formed of that stratum of the moss only that lies four feet below the surface and downwards; the rest is improper for the purpose, and is thrown aside.

Before the introduction of the plan which is now pursued, two methods chiefly were employed to gain land from the moss. 1st, The surrounding farmers marked off yearly a portion of the low moss next to their arable land, about 15 feet broad. This they removed with carts and spread upon their fields, some acres of which they for that end left unsown. Here it lay till May or June; when, being thoroughly dry, it was burnt to ashes to serve as a manure. By this means they added to their farms about half a rood of land yearly. But this plan proved unsuccessful; for by the repeated application of these ashes, the soil was rendered so loose that the crops generally failed. 2dly, Many farmers were wont to *trench down* the low moss, and to cover it *furrow deep* with clay taken out of the trench. This, though commendable as an attempt to improve,

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It has been attempted to cover the moss with clay brought from the adjacent grounds. But what from the necessary impoverishment of the ground from which the clay was carried, and the softness of the moss, this was soon found to be impracticable.

Draining has also been proposed as another mode of improvement; and it must be acknowledged, that, by means of draining, many mosses have been converted both into arable and meadow grounds, which in the end became interesting improvements. But in a moss, such as that of Kincardine, this method would be ineffectual; as for several feet deep it is of such a nature, that upon being dry, and divided into parts, it would blow with the wind like chaff; and when thrown aside in the operation of digging peats, it lies for years without producing a single vegetable, except only a few plants of sorrel.

Hence it was thought evident, that all attempts to improve this moss must ever prove abortive; and that the object to be had in view was the acquisition of the valuable soil lying underneath; to which end nothing less was requisite than the total abolition of the moss.

By the methods above described from 100 to 200 acres of moss had been removed. When the present plan was introduced, there still remained covered with moss from 1300 to 1400 acres of carse clay—a treasure for which it must be ever interesting to dig.

In the year 1766 Lord Kames entered into possession of the estate of Blair Drummond. Long before that period he was well acquainted with the moss, and often lamented that no attempt had ever been made to turn it to advantage. Many different plans were now proposed; at length it was resolved to attempt by means of water, as the most powerful agent, entirely to sweep off the whole body of moss.

That moss might be floated in water, was abundantly obvious; but to find water in sufficient quantity was difficult, the only stream at hand being employed to turn a corn mill. Convinced of the superior consequence of dedicating this stream to the purpose of floating off the moss, Lord Kames having made an agreement with the tenant who farmed the mill, and the tenants thirled consenting to pay the rent, he immediately threw down the mill, and applied the water to the above purpose.

In order to determine the best manner of conducting the operation, workmen were now employed for a considerable time upon the low moss, both by the day and by the piece, to ascertain the expence for which a given quantity of moss could be removed. It was then agreed to operate at a certain rate per acre; and in this manner several acres were removed.

But this was to be a very expensive process. The ground gained might, indeed, be afterwards let to tenants; but every acre would require an expenditure from 12l. to 15l. before it could be ready for sowing; so that the acquisition of the whole, computing it at a medium to be 1360 acres, would sink a capital of nearly 20,000l. sterling.

One other method still remained; namely, to attempt letting portions of the moss, as it lay, for a term of years sufficient to indemnify tenants for the expences

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In the mean time it was determined, till as many tenants should be got as could occupy the whole water, to carry on the work by means of undertakers.

But before proceeding farther, it will be necessary to describe the manner of applying water to the purpose of floating the moss.

A stream of water sufficient to turn a common corn-mill will carry off as much moss as 20 men can throw into it, provided they be stationed at the distance of 100 yards from each other. The first step is to make in the clay, alongside of the moss, a drain to convey the water: and for this operation the carse clay below the moss is peculiarly favourable, being perfectly free from stones and all other extraneous substances, and at the same time, when moist, slippery as soap; so that not only is it easily dug, but its lubricity greatly facilitates the progress of the water when loaded with moss. The dimensions proper for the drain are found to be two feet for the breadth and the same for the depth. If smaller, it could not conveniently receive the spadefuls of moss; if larger, the water would escape, leaving the moss behind. The drain has an inclination of one foot in 100 yards; the more regularly this inclination is observed throughout, the less will the moss be liable to obstructions in its progress with the water. The drain being formed, the operator marks off to a convenient extent alongside of it a section of moss, 10 feet broad; the greatest distance from which he can heave his spadeful into the drain. This he repeatedly does till the entire mass be removed down to the clay. He then digs a new drain at the foot of the moss bank, turns the water into it, and proceeds as before, leaving the moss to pursue its course into the river Forth, a receptacle equally convenient and capacious; upon the fortunate situation of which, happily forming for several miles the southern boundary of the estate, without the interposition of any neighbouring proprietor, depended the very existence of the whole operations.

When the moss is entirely removed, the clay is found to be encumbered with the roots of different kinds of trees standing in it as they grew, often very large: their trunks also are frequently found lying beside them. All these the tenants remove, often with great labour. In the course of their operations they purposely leave upon the clay a stratum of moss six inches thick. This, in spring, when the season offers, they reduce to ashes, which in a great measure ensures the first crop. The ground thus cleared is turned over, where the dryness admits, with a plough, and, where too soft, with a spade. A month's exposure to the sun, wind, and frost, reduces the clay to a powder fitting

Preparation of Land. fitting it for the seed in March and April. A crop of oats is the first, which seldom fails of being plentiful, yielding from eight to ten bolls after one.

In the year 1767 an agreement was made with one tenant for a portion of the low moss. This, as being the first step towards the intended plan, was then viewed as a considerable acquisition. The same terms agreed upon with this tenant have ever since been observed with all the rest. They are as follow:

The tenant holds eight acres of moss by a tack of 38 years; he is allowed a proper quantity of timber, and two bolls of oatmeal to support him while employed in rearing a house; the first seven years he pays no rent; the eighth year he pays one merk Scots; the ninth year two merks; and so on with the addition of one merk yearly till the end of the first 19 years; during the last five years of which he also pays a hen yearly. Upon the commencement of the second 19 years, he begins to pay a yearly rent of 12s. for each acre of land cleared from moss, and 2s. 6s. for each acre not cleared, also two hens yearly: A low rent indeed for so fine a soil: but no more than a proper reward for his laborious exertions in acquiring it.

In the year 1768 another tenant was settled. These two were tradesmen; to whom the preference was always given, as having this great advantage to recommend them, that even when deprived of water they need never want employment. The motives that induced these people to become settlers were, 1st, The prospect of an independent establishment for a number of years. 2dly, The moss afforded them great abundance of excellent fuel; to which was added the comfortable consideration, that, while busied in providing that necessary article, they had the double advantage of promoting, at the same time, the principal object of their settlement.

Notwithstanding these inducements, still settlers offered slowly: to which two circumstances chiefly contributed: 1st, The whole farmers surrounding the moss threw every possible obstruction in their way. 2dly, By people of all denominations the scheme was viewed as a chimerical project, and became a common topic of ridicule. The plan, however, supported itself; and in the year 1769 five more tenants agreed for eight acres each; and thus 56 acres of low moss were disposed of. From the progress made by the first settlers, and the addition of these, the obloquy of becoming a moss tenant gradually became less regarded; so that in the year 1772 two more were added; in 1773, three; and in 1774, one; in all 13: which disposed of 104 acres: all the low moss to which water could then be conveyed. As water is the mainspring of the operation, every tenant, besides the attention necessary to his share of the principal stream, collected water by every possible means, making ditches round his portion of the moss, and a reservoir therein to retain it till wanted.

The tenants in the low moss having now begun to raise good crops, in the year 1774 several persons offered to take possessions in the high moss, upon condition that access to it should be rendered practicable. The high moss wanted many advantages that the low possessed. To the low moss, lying contiguous to the surrounding arable lands, the access was tolerably good; but from the arable lands the high moss was separat-

ed by 300 or 400 yards of the low, which even to a man, affords but indifferent footing, and to horses is altogether impracticable. The low moss is in general only three feet deep; the high moss is from six to twelve feet in depth.

It will appear at first sight, that without a road of communication the high moss must forever have proved unconquerable. Without delay, therefore, a road was opened to the breadth of 12 feet, for several hundred yards in length, by floating off the moss down to the clay.

This being effected, and at the same time an opening given to admit water, in the year 1775 twelve tenants agreed for eight acres of high moss each. In consideration of the greater depth of this part of the moss, it was agreed, that during the first 19 years they should pay no rent; but for the second 19 years the terms of agreement were the same as those made with the tenants in the low moss. To the above-mentioned tenants every degree of encouragement was given; as upon their success depended, in a great measure, the disposal of the great quantity of moss still remaining. But their success, however problematical, was such, that next year, 1776, six more took eight acres each; in 1777, one; in 1778, four; in 1779, three; in 1780, one; in 1781, one; in 1782, one:—In all, including those upon the low moss, 42 tenants, occupying 336 acres.

Though for some time the disposal of the high moss went but slowly on, it was not for want of tenants; but the number of operators was already sufficient for the quantity of water; to have added more would evidently have been imprudent.

In the year 1783 Mr Drummond entered into the possession of the estate of Blair Drummond, and went fully into the plan adopted by his predecessor for subduing the moss. At this time there still remained undisposed of about 1000 acres of high moss. As water was the great desideratum, it was determined, that to obtain that necessary article, neither pains nor expence should be wanting. Steps were accordingly taken to ascertain in what manner it might be procured to most advantage.

Meanwhile, to prepare for new tenants, a second road parallel to the former, at the distance of half a mile, was immediately begun and cut, with what water could be got, down to the clay, 12 feet broad and 2670 yards long, quite across the moss. This opening was previously necessary, that operators might get a drain formed in the clay to direct the water; and it was to remain as a road that was absolutely necessary, and which relieved settlers from an expence they were unable to support. These preparations, the progress of the former tenants, and the prospect of a farther supply of water, induced 10 more to take possessions in the year 1783: in the year 1784, 18 more took possessions; and in 1785 no fewer than 27: in all 55 tenants in three years: which disposed of 440 acres more of the high moss.

As the introduction of an additional stream to the moss was to be a work both of nicety and expence, it was necessary to proceed with caution. For this reason several engineers were employed to make surveys and plans of the different modes by which it might be procured. In one point they all agreed, that the proper

Preparation of Land. per source for furnishing that supply was the river Teith, a large and copious stream that passes within a mile of the moss; but various modes were proposed for effecting that purpose.

To carry a stream from the river by a cut or canal into the moss was found to be impracticable; and Mr Whitworth (B) gave in a plan of a pumping machine, which he was of opinion would answer the purpose extremely well.

Soon after this Mr George Meikle of Alloa, a very skilful and ingenious millwright, gave in a model of a wheel for raising water entirely of a new construction, of his own and his father's invention jointly. This machine is so exceedingly simple, and acts in a manner so easy, natural, and uniform, that a common observer is apt to undervalue the invention: But persons skilled in mechanics view machinery with a very different eye; for to them simplicity is the first recommendation a machine can possess. Accordingly, upon seeing the model set to work, Mr Whitworth, with that candour and liberality of mind that generally accompany genius and knowledge, not only gave it the greatest praise, but declared that, for the purpose required, it was superior to the machine recommended by himself, and advised it to be adopted without hesitation.

The better to explain this machine, two sketches are annexed, to the first of which the following letters refer. The explanation of the second will be found upon the sketch.

late XIII. *a*, Sluice through which is admitted the water that moves the wheel.

b, b, Two sluices through which is admitted the water raised by the wheel.

c, c, A part of one of two wooden troughs and an aperture in the wall, through which the above water is conveyed into the buckets. [The other trough is hid by two stone walls that support the wheel.]

d, d, d, Buckets, of which 80 are arranged on each side of the arms of the wheel=160.

e, e, e, A cistern into which the water raised by the buckets is discharged.

f, f, f, Wooden barrel pipes, through which the water descends from the cistern under ground to avoid the high road from Stirling, and the private approach to the house.

Sketch second contains a plan of the cistern, and exhibits the manner in which the water is filled into the buckets.

The diameter of the wheel to the extremities of the float-boards is 28 feet; the length of the float-boards 10 feet. The wheel makes nearly four revolutions per minute; in which time it discharges into the cistern 40 hogsheads of water. But this is not all the wheel is capable of performing; for by several accurate trials by Messrs Whitworth and Meikle, in the result of which, though made separately, they perfectly agreed, it was found that the wheel was able to lift no less than 60 hogsheads per minute; but that the diameter of the pipes through which the water descends from the ci-

tern would not admit a greater quantity than what they already receive.

To a person at all conversant in hydraulics, the resemblance of this to the Persian wheel must be obvious: and indeed it is probable, that from the Persian wheel the first idea of this machine was derived. But admitting this, still the superiority of the present wheel is, in most respects, so conspicuous, as to entitle it to little less praise than the first invention. For, 1st, In the Persian wheel, the buckets being all moveable, must be constantly going out of order: in this wheel they are all immoveable, consequently can never be out of order. 2dly, Instead of lifting the water from the bottom of the fall, as in the Persian wheel, the wheel lifts it from the top of the fall, being from four to five feet higher; by which means some additional power is gained. 3dly, By means of the three sluices (*a*, and *b, b*, fig. 1.) in whatever situation the river may be, the quantity of the water to be raised is so nicely adjusted to that of the moving power, as constantly to preserve the wheel in a steady and equable motion. In short, as a regulator is to a watch, so are these sluices to this wheel, whose movements would otherwise be so various, as sometimes to carry the water clear over the cistern, sometimes to drop it entirely behind, but seldom so as fully to discharge the whole contents of the bucket into the cistern.

It is however but candid to remark, that this machine labours under a small defect, which did not escape the observation of Mr Whitworth; namely, that by raising the water about $3\frac{1}{2}$ feet higher than the cistern where it is ultimately delivered, a small degree of power is lost. To this, indeed, he proposed a remedy; but candidly confessed, that as it would render the machine somewhat more complex, and would also increase the friction, he thought it more advisable to keep it in its present state. At the same time he justly observed, that as the stream by which the wheel is moved is at all times copious and powerful, the small loss of power occasioned by the above circumstance was of little or no avail.

This stream is detached from the Teith at the place where the river approaches nearest to the moss. The surface of the latter is about 15 feet higher than that of the former; the cistern is therefore placed 17 feet above the surface of the stream, so as to leave a declivity sufficient to deliver the water upon the surface of the moss.

The pipes through which the water descends from the cistern are composed of wooden barrels hooped with iron, 4 feet long and 18 inches in diameter within.

In these pipes, having been conveyed under ground for 354 yards from the cistern, the water at once emerges into an open aqueduct. The aqueduct which was formed according to a plan by Mr Whitworth, is constructed wholly of earth or clay; and in order to keep the water on a level with the surface of the moss, it is for nearly two-thirds of its course elevated from 8 to 10 feet above the level of the adjacent grounds; the base being 40 feet broad, the summit 18 feet, and the

3 B 2

water

(B) This gentleman was superintendant of the London water-works, and an engineer of great reputation in England. He was several years employed in Scotland in completing the great canal.

Preparation of Land. water course 10 feet broad. It commences at the termination of the pipes; from whence extending above 1400 yards, it discharges the water into a canal formed for its reception on the surface of the moss.

For raising the water to this height there were two reasons: 1st, That not only where it was delivered on the moss, but even after being conveyed to the most distant corners, it might still retain sufficient power to transport the moss to the river Forth. 2dly, That reservoirs of a sufficient height might be formed in the moss to retain the water delivered during night.

In consequence of Mr Whitworth's advice, a contract was entered into with Mr Meikle in spring 1787; and by the end of October in that year, the wheel, pipes, and aqueduct, were all completely finished; and what, in so complex and extensive an undertaking, is by no means common, the different branches of the work were so completely executed, and so happily adjusted to each other, that upon trial the effect answered the most sanguine expectations. The total expence exceeded 1000l. sterling.

To induce the proprietor to embark in this undertaking, the moss tenants had of their own accord previously come under a formal engagement to pay the interest of any sum that might be expended in procuring a supply of water. But he was determined they should not enjoy by halves the sweets of this long wished for acquisition. With a view, therefore, not only to reward their past industry, but to rouse them to future exertion, he at once set them free from their engagement; nor has any interest ever been demanded.

This new supply was a most acceptable boon to the moss tenants. In order to make an equitable distribution, the water raised through the day was allotted to one division of operators; that raised during the night to another. To retain the latter, a canal was formed, extending almost three miles through the centre of the moss. From place to place along the sides are inserted sluices to admit water to the reservoirs of the possessors; each sluice having an aperture proportioned to the number of operators to be supplied from the reservoir which it fills. For the water raised through the day no reservoirs are necessary; as it is immediately used by the division to which it is allotted.

This additional stream, though highly beneficial, yet is not more than sufficient to keep 40 men at constant work. But such a quantity as would give constant work is not necessary: the operators must be often employed in making and repairing their drains, grubbing up roots of trees, &c.; so that a quantity sufficient to give five or six hours work per day to the whole inhabitants is as much as would be wanted. But as the quantity procured was still insufficient for this purpose, a small stream that descended from the higher grounds was diverted from its course and brought into the moss. From want of level this stream could not be delivered to the greatest advantage; namely, upon the surface of the moss. Yet by making, at a considerable expence, a drain half a mile long, and a reservoir for the night water, it was rendered of much importance: and during the whole winter months, as well as in summer, after every fall of rain, it keeps 15 persons fully employed.

*In the year 1787, two more tenants agreed for Preparation of Land. eight acres each; in 1788, four; in 1789, eight; in 1790, four tenants, all agreed for the same number of acres.

The whole moss was now disposed of, except that part called *Flow Moss*, which comprehended about 400 acres. Here it is twice the usual breadth, so fluid that a pole may be thrust with one hand to the bottom; and the interior part, for near a mile broad, is three feet above the level of all the rest of the moss. Hitherto the many and various difficulties that presented themselves had been overcome by perseverance and expence. But here the extraordinary elevation of the morass, joined to its great fluidity, seemed to exclude all possibility of admitting a stream of water; and it was the general opinion that the moss operations had now arrived at their *ne plus ultra*, and that this morass was doomed to remain a nuisance for ages to come.

But the proprietor had now advanced so far that he could not submit to retreat: and he considered himself as in some measure pledged to the country for the completion of this undertaking. To detail the various methods practised to introduce a stream of water into that morass, would prove tedious. It is sufficient to say, that after a thousand unsuccessful efforts, attended with much trouble and considerable expence, the point at last was gained, and a stream of water was brought in and carried fairly across the centre of the morass.

The greatest obstacle was now indeed overcome; but still another remained of no small moment, namely, the discouragement given to settlers from the total impossibility of erecting habitations upon the surface of this morass. To find a remedy for this evil was difficult. Happily a resource at last occurred. This was to bargain with a certain number of the old tenants, whose habitations were nearest, to take leases of portions of the morass. But as some additional aid was here necessary, it was agreed that 12l. sterling should be gradually advanced to each tenant till he should accomplish the clearing of an acre, for which he or his successor is bound to pay 12s. of yearly rent, equal to five per cent. upon the sum advanced. When this point shall be gained, they are bound to dispose, as most agreeable to themselves, either of their old or of their new possession; for which, when once an acre is cleared, purchasers will not be wanting.

In consequence of the above arrangement, during the year 1791 no fewer than 35 of the old tenants agreed, upon the foresaid conditions, for eight acres each of the flow moss. Thus 1200 acres are now disposed of to 115 tenants. But when these 35 tenants shall each have cleared their acre, then, according to agreement, 35 additional tenants will speedily be acquired; and the moss will then contain in all 150 families.

To the leases at first granted to the tenants in the high moss, it was afterwards determined to add a further period of 19 years (making in all 57 years), during which they are to pay one guinea per acre; a rent not greater than the land is worth even at present, but greatly below its probable value at that distant period. This, it is hoped, will prove to the tenants a sufficient incitement

Preparation of Land. ment to continue their operations till their possessions are completely cleared from moss.

Having now gone through, in detail, the whole progress of the colony for many years after its first settlement in the year 1767, it still remains to take a general view of the effects produced by that establishment.

For several years, at first, the water was used chiefly to carry off moss, in the forming of new roads, and preparing reservoirs; which considerably retarded the principal object, of gaining land. Nevertheless there have been cleared full 300 acres of excellent land, producing wheat, barley, oats, and clover, yielding from six to twelve bolls after one.

From the nature of the undertaking, there is good reason to suppose that the operations will yearly advance with greater rapidity; especially as the greater number of the settlers have only of late begun to operate. Many, besides maintaining their families otherwise by occasional employments, have in the high moss cleared in a year one rood of land; some have cleared two, some three roods, and in the low moss an acre.

It was a remark often made, even by persons of some observation, that by collecting together such a number of people, Kincardine would be overstocked; and the consequence would be their becoming a burden on the parish: for as the bulk of them were labourers not bred to any trade, and possessed of little stock, it was foreseen, that, for some time, they could not afford to confine themselves solely to the moss, from which the return must be slow; but behaved, for immediate subsistence, to work for daily hire. Happily these predictions have proved entirely groundless; for such is the growing demand for hands in this country, that not only do the whole of these people find employment whenever they choose to look for it, but their wages have been yearly increasing from the time of their first establishment. In short, they have proved to the corner where they are set down a most useful nursery of labourers; and those very farmers, who, at first, so strongly opposed their settlement, now fly to them as a sure resource for every purpose of agriculture. Still they consider the moss operations as their principal business; none pay them so well; and when they do leave it to earn a little money, they return with cheerfulness to their proper employment. Many of them already raise from 10 to 60 bolls of grain, and have no occasion to go off to other work; which will soon be the case with the whole. Their original stock, indeed, did not often exceed 25l. and some had not even 10l.; but what was wanting in stock is compensated by industry.

Of the whole inhabitants full nine tenths are Highlanders, from the neighbouring parishes of Callander, Balquhitter, &c.; a sober, frugal, and industrious people, who, inured to hardships in their own country, are peculiarly qualified to encounter so arduous an undertaking. From this circumstance, too, arises a very happy consequence; that wearing a different garb and speaking a different language from the people amongst

whom they are settled, they consider themselves in a manner as one family transported to a foreign land: and hence upon all occasions of difficulty, they fly with alacrity to each others relief. Neither ought it to be forgotten, that, from their first settlement to the present day, not a single instance has occurred amongst them of theft, bad neighbourhood, or of any other misdemeanour, that required the interposition of the civil magistrate. Nor, however poor in circumstances, has any one of them ever stooped to solicit assistance from the funds of the parish appropriated to that purpose.

Though few of the tenants entered with a large stock, one only has been obliged to leave the moss from incapacity to proceed. Many indeed have spent their small stocks, and even run a little in debt: but in this case they have been permitted to sell their tacks upon the following conditions: 1st, That the purchaser shall be a good man; 2dly, That the seller shall take another possession. By this manœuvre a new inhabitant is gained; while the old one, relieved from debt, and aided by past experience, recommences his operations with double spirit upon a new possession. The moneyed man again has at once a house and a piece of ground, the want of which chiefly startled new beginners.

Some have even made a kind of trade of selling; insomuch, that from the year 1774 to the year 1792, no fewer than fifty sales have taken place, producing in all the sum of 849l. sterling. This proved from time to time a most seasonable recruit to the colony, and gave new vigour and spirits to the whole.

The number of the settlers is productive of an excellent effect; that although some are generally absent, enough still remain to occupy the water constantly. In a favourable day, there may be seen hundreds, men, women, and children, labouring with the utmost assiduity. The women declare they can make more by working at the moss than at their wheel; and such is the general attachment to that employment, that they have frequently been discovered working by moonlight.

Another happy consequence arising from their numbers is the great quantity of moss they consume for fuel. There are in all 115 families. Each family requires at an average 10 dargues (c) of peats yearly. Each dargue uncovers a space equal to 10 square yards of clay; so that, by casting peats, the moss tenants gain yearly about 6 roods of land.

The advantage, too, of providing their fuel with so little trouble, is very great. They require yearly 1150 dargues of peats; which, as each dargue when dried and stacked is valued at five shillings, are worth 287l. 10s. sterling; a sum which otherwise must have been expended on the prime cost and carriage of coals.—Many of them cast peats for sale; and 100l. worth are yearly disposed of in the town of Stirling, the village of Down, &c.

Though moss work be laborious, it is at the same time amusing. The operator moves the moss five feet only at a medium; and the water, like carts in other cases,

(c) A dargue (or darg) of peats, is the quantity that one man can cast and two can wheel in a day to the field where they are spread out to dry.

Preparation of Land. cases, carrying it off as fast as it is thrown in, excites him to activity. Still he must submit to be wet from morning to night. But habit reconciles him to this inconvenience; while his house and arable land fill his eye and cheer his mind. Nor is it found that the health of the inhabitants is in the smallest degree injured either by the nature of the work or the vicinity of the moss.

The quantity of moss that one man can move in a day is suprising; when he meets with no interruption, seldom less than 48 cubic yards, each weighing 90 stones. The weight, then, of moss moved per day is no less than 4320 stones. A cubic yard is moved into the water, and of course carried into the river Forth for one farthing. It follows, that the expence of moving 48 cubic yards is one shilling. But the same quantity moved to the same distance by carts would cost 24 shillings. Hence the advantage derived from the possibility of floating moss in water, and the great importance of having water for that purpose.

The moss, when contrasted with the rich lands surrounding, appeared, especially before the improvements, a very dreary spot; one wide unvaried wild, totally unproductive, unfit even to furnish sustenance to any animal, except here and there a few wretched straggling sheep. Besides, it entirely cut off all connexion betwixt the farms on either side; among which no intercourse was practicable but by a circuit of several miles.

The scene is already greatly changed. The following are the numbers of the inhabitants who some years ago resided in the moss; also of their cows and horses, and of the acres gained by them from the moss, together with their produce.

Men	-	-	-	-	115
Women	-	-	-	-	113
Boys	-	-	-	-	199
Girls	-	-	-	-	193
Total					620
Number of cows, at least	-	-	-	-	115
Ditto of horses and carts,	-	-	-	-	34
Ditto of acres cleared from moss,	-	-	-	-	300

The produce in bolls cannot be exactly ascertained: but, considering the goodness of the soil, may be fairly stated at 8 bolls per acre. *Inde* 2400 bolls.

As oats are the staple commodity, the calculation shall be confined to that grain. According to the fiars of Stirlingshire, crop 1790, carse oats are valued at 14s. per boll. *Inde* 2400 bolls at 14s. is 1680l. Of late this price has at times been doubled.

A tract of ground so considerable, formerly a nuisance to the country, thus converted into a fertile field, filled with inhabitants, comfortable and happy, cannot surely be surveyed with an eye of indifference by any person whose mind is at all susceptible of feeling or of public spirit.

An excellent gravelled road, 20 feet wide and a mile and a half long, is now carried quite across the

moss. By this means, in the first place, a short and easy intercourse is established between two considerable parts of the estate, formerly as little connected as if separated by a lake or an arm of the sea. Secondly, The inhabitants of the moss, to whom, hitherto, all passage with carts or horses was impracticable for at least one half of the year, have now obtained the essential advantage of being able, with ease, to transport all the different commodities at every season of the year. This road was entirely formed by the hands of the moss tenants, and gravelled by their own carts and horses: a work which, it will not be doubted, they performed with much alacrity; when it is considered that, to the prospect of procuring a lasting and material benefit to themselves, there was joined the additional inducement of receiving an immediate supply of money, the whole being done at the proprietor's expence.

The possessions are laid off in the manner best fitted for the operations; and are divided by lanes running in straight lines parallel to each other. Parallel to these again the drains are carried: and this straight direction greatly facilitates the progress of the water with its load of moss. Upon the bank of moss fronting the lanes, the operation of floating is begun; and twenty or thirty people are sometimes seen heaving moss into the same drain. That the water may be the more conveniently applied, the lanes include between them the breadth of two possessions only. The new houses are erected upon each side of these lanes at the distance of 100 yards from each other.

Before the formation of lanes and roads, and while yet no ground was cleared, the first settlers were obliged to erect their houses upon the surface of the moss. Its softness denied all access to stones; which, at any rate, are at such a distance as would render them too expensive. Settlers, therefore, were obliged to construct their houses of other materials. Upon the low moss there is found for this purpose great plenty of sod or turf, which accordingly the tenants use for the walls of their houses. For the rudeness of the fabric nature in some measure compensates, by overspreading the outside with a luxuriant coating of heath and other moorish plants, which have a very picturesque appearance.

But upon the high moss there is no sod to be found. There the tenant must go differently to work. Having chosen a proper situation for his house, he first digs four trenches down to the clay, so as to separate from the rest of the moss a solid mass, containing an oblong rectangular area, sufficiently large for his intended house. This being done, he then scoops out the middle of the mass, leaving on all sides the thickness of three feet for walls; over which he throws a roof, such as that by which other cottages are commonly covered.

Upon the softest parts of the moss, even these walls cannot be obtained. In such places the houses are built with peat dug out of the moss, and closely compressed together while in a humid state (D). It is necessary

(D) This does not apply to the *morass*, upon the surface of which, it has already been observed, it is impossible to erect houses in any shape.

Preparation necessary even to lay upon the surface a platform of boards to prevent the walls from sinking; which they have frequently done when that precaution was neglected. After all, to stamp with the foot will shake the whole fabric as well as the moss for fifty yards around. This, at first, startled the people a good deal; but custom soon rendered it familiar.

The colonists have now made considerable advancement in rearing better habitations for their comfort and convenience. Their huts of turf are but temporary lodgings. As soon as they have cleared a little ground, they build houses of brick: when the proprietor a second time furnishes them with timber gratis. It has also been found necessary to relieve them entirely from the payment of the burdensome tax upon brick; a tax which surely was never intended to fall on such poor industrious adventurers; and which, without this assistance, would have proved a most effectual bar to the employment of these materials.

There are now erected in the moss 69 brick houses, substantially built with lime. The total expence amounted to 1033l. sterling. And it is a very comfortable circumstance, that the money expended upon these houses is mostly kept in circulation among the inhabitants themselves; for as a number of them have learned not only to manufacture but also to build bricks, and as others who have horses and carts furnish the carriage of lime and coals, they thus interchange services with each other.

With a view to excite the exertion of the colonists, the following premiums were also offered: 1. To the person who shall in the space of one year remove the greatest quantity of moss down to the clay, a plough of the best construction. 2. To the person who shall remove the next greatest quantity, a pair of harrows of the best kind. 3. For the next greatest quantity, a spade of the best kind, and 10lb. of red clover seed. But as these premiums, if contested for by the whole inhabitants, could reach but a very few of the number, they were therefore divided into six districts according to their situation; and the above premiums were offered to each district.

The establishment of this colony was no doubt attended with a very considerable share of expence and difficulty; for the undertaking was altogether new, and there were many prejudices against it, which it was necessary to overcome. At the same time it was noble and interesting: it was to make a valuable addition to private property; it was to increase the population of the country, and to give bread to a number of people, many of whom having been turned out of their farms and cottaries in the Highlands, might otherwise, by emigration, have been lost to their country; and that too, at a time when, owing to the great enlargement of farms, depopulation prevails but too much even in the low countries. And it was to add to the arable lands of the kingdom, making many thousand bolls of grain to grow where none ever grew before.

These considerations have hitherto preponderated with the proprietors against the various obstacles that present themselves to the execution of so extensive an undertaking. Should their example tend in any degree to stimulate others, who both in Scotland and in England possess much ground equally useless to the

country, to commence similar improvements, it would be a most grateful consideration superadded to the pleasure already arising from the progress of the infant colony.

After all it will probably hereafter be thought, that the great efforts of ingenuity, and of persevering industry, which were requisite in the above operation, might all have been avoided, and the work much easier performed, had the art been found out of converting moss into fruitful soil, according to the plan practised, and undoubtedly brought to great perfection in Ayrshire, by the gentleman already mentioned, John Smith, Esq. of Swinridgemuir, near Beith. On a part of a moss in this gentleman's property, a quantity of lime had been spread in consequence of the miring of some carts in wet weather; to relieve which, their load was laid over the ground in their neighbourhood, though this was accounted at that period an absurd operation, as it was believed that lime would have the effect of consuming and rendering mossy ground useless for ever. The proprietor Mr Smith, was then in the army, towards the close of the American war. On returning home the succeeding summer, and being informed of the accident, he was surprised to find that as good a crop grew upon the patch of moss on which the lime had been scattered, as upon another spot that had been pared and burned, in consequence of instructions that he had transmitted home for that purpose, from having perused some treatises in which burning of moss was recommended. He also remarked, that upon the places which had neither been burned nor limed, nothing grew, and that the crop upon the burned soil was inferior to that where the lime had been laid, being almost choked with sorrel. Mr Smith pursued the hint thus obtained: He reclaimed by means of lime every portion of moss in his own possession, and having satisfied his tenants of the utility of the practice, he allowed them to dig limestone gratis, and gave them the refuse of his coal at prime cost to burn it. Thus, in a short time, every part of the moss upon his estate was reduced under cultivation, and rendered highly valuable.

When Mr Smith began his operations, he met the fate of innovators in agriculture, that is, he was ridiculed by all his neighbours. His success, however, at length made some converts, and though the new system at first advanced slowly, it was at last universally approved of, and extensively imitated. The result has been, that what was once the worst land in the country, is now become the most productive and fertile.

The following is a concise statement of Mr Smith's practice, and consequently of the Ayrshire practice, of actually converting moss into vegetable mould, capable of bearing rich crops of corn, hay, potatoes, &c. which we shall give in the words of Mr Headrick.

"1. When they enter upon the improvement of a moss in a natural state, the first thing to be done is, to mark and cut main or master drains, eight feet in width, by four and a half in depth, and declining to two and a half at bottom; these cost 1s. per fall of six Scots ells. In some instances, it will be found necessary to cut those drains much deeper, consequently at a greater expence. These drains almost in every instance can be, and are so conducted, as to divide the field into regular and proper enclosures. They always make it a rule to finish off as much of a drain as they have broken

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Preparation of Land. broken up, before they leave it at night; because, if a part is left dug, suppose half way, the oozing of water from the sides would render the bottom so soft, that they could neither stand upon it nor lift it with the spade. When the moss is so very soft, that the pressure of what is thrown out of the drain may cause its sides to fall in again, they throw the clods from the drain a considerable way back, and sometimes have a man to throw them still further back, by a spade or the hand; for this reason too, they always throw the stuff taken from a drain as equally as possible on each side of it. In digging the drains, the workmen stand upon small boards to prevent them from sinking, and move them forward as the work advances.

"When the moss lies in a hollow, with only one outlet, it is necessary to lead up a drain, so as to let the water pass this outlet, and then conduct it along the lowest or wettest part of the moss: this middle drain is afterwards sloped, and the stuff thrown back into the hollows that may occur; upon it the ridges are made to terminate on each side, while a ring drain, serving the purpose of a fence, is thrown round the moss at the line where the rising ground commences. This can generally be so managed as to divide the moss into a square field, leaving straight lines for the sides of the contiguous fields. The ring drain intercepts the surface water from the higher grounds, and conducts it into the lower part of the outlet, while the sloped drain in the centre receives and discharges all the water that falls upon the moss."

"After the moss collapses in consequence of liming and culture, it is often necessary to clean out these drains a second time, and to dig them to a greater depth: their sides become at last like a wall of peat, which few animals will venture to pass."

"2. The drains being thus completed, they mark out the ridges, either with a long string or with three poles set in a line. Mr Smith has tried several breadths of ridges, but now gives a decided preference to those that are seven yards in breadth. The ridges are formed with the spade in the following manner: In the centre of each intended ridge, a space of about two feet is allowed to remain untouched; on each side of that space a furrow is opened, which is turned over so as completely to cover that space, like what is called *veering* or *feering* of a gathered ridge; the work, thus begun, is continued by cutting furrows with the spade, and turning them over from end to end of the ridge on each side, until they arrive at the division furrows. The breadth of the slices thus cut, may be about 12 inches, and each piece is made as long as it may suit to turn over: the ridge, when finished, has the appearance of having been done with a plough. The division furrow is two feet in breadth, which, if necessary to draw off superfluous water, is partly cut and thrown upon the side, or into hollows in the ridges on each side. The depth of the division furrows is regulated by circumstances, so as not to lay the ridges at first too dry, but at the same time to bleed, as it were, the moss, and conduct the superfluous water into the master drains."

"3. The next operation is to top-dress the ridges with lime. The sooner this is done after the ridges are formed, the better. When the moss appears dry, experienced farmers throw on the lime, but do not clean

out the division furrows until the ensuing winter. *Preparation of Land.* When it is soaked in water, they clean the division furrows as soon as the lime is ready, and after the water has run off apply the lime immediately. It is of great importance to have the lime applied while the moss is still moist, and the lime in as caustic a state as possible. For this purpose, they have the lime conveyed from the kiln in parcels, slaked and laid on as fast as the ridges are formed. Being dropped from carts, and slaked at the nearest accessible station, it is carried to the moss by two men on light handbarrows, having a hopper and bottom of thin boards, and there spread with shovels as equally as possible. During the first and second years, the crop is generally carried off in the same way. In some places where a moss is covered with coarse herbage, and accessible by carts in dry weather, I saw them give a good dose of lime to the moss before it was turned up with the spade, and another after the ridges were formed. It is surprising how quickly they execute these operations with the handbarrows. In other places where coarse boards can be procured, they lay a line of them along the crown of a ridge, and convey the lime upon them in wheelbarrows."

"The proportion of lime allowed to the acre is various, being from three to eight chalders. Improvers are much less sparing of this ingredient now than formerly, and much greater proportions have been applied with good effect. Suppose 120 bolls, or 480 Winchester bushels, of slaked or powdered lime allowed to every Scots acre, this would cost at the sale kilns 40s.; and thus the reader may be enabled to calculate the expence of lime in this district at every given proportion: But most of the farmers here burn lime for themselves in vast kilns of sod, and think they have it much cheaper than it could be got from a sale kiln. In many places, limestone abounds so much, that houses, fences, and roads are constructed with it; and when a farmer burns the limestone within his premises, he at least saves the expence of carriage."

"In some cases, after the limestone is laid on, they go over the ground with hoes, or with spades, hacking and mangling the clods, and mixing the lime more completely with the superficial soil; but where there is much to do, and hands are scarce, they never think of these operations."

"4. The field thus prepared is ready to receive the seed, which is sown at the proper season whether it be *wet* or *dry*, and harrowed in with a small harrow drawn by two men. Four men will with ease harrow at least five or six roods per day, two and two dragging the harrow by turns, and two breaking and dividing the mould with spades. When the lime has been applied early the preceding summer, a good crop of oats may generally be expected; but if it has been recently applied, the first crop of oats frequently misgives, as the lime has not time to combine with the moss, and form it into a soil."

"The early Dutch or Polish oats are always preferred by moss improvers, as the common Scots or late oats are too apt to run into straw, and lodge before the grain arrives at maturity. The same proportion of seed is allowed per acre that is usual in other places. The great desideratum is, to procure plants which will throw up a sufficient quantity of herbage, so as to shield the

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"This desideratum is effectually supplied by the potato, which thrives well on moss at all times, whether recently opened up and limed, or at any future period of its cultivation; only it requires a proportion of stable dung. It is now become the general practice in Ayrshire, to plant potatoes on those mosses which have been but recently turned up and limed; and where dung can be procured, it is generally the first crop on all their mosses.

"The method of planting potatoes, whether they be the first crop or succeed the first crop of oats, is by lazy beds. If they be the first crop, the moss having been delved into ridges, and limed as before directed, spaces of from five to six feet in breadth are marked out across the ridges, having intervals of about two feet, from which the moss is taken to cover the sets. These spaces or beds are covered over with a thin *stratum* of dung, laid upon the surface of the lime at the rate of about sixteen tons to the Scots acre. The cuttings of the potatoes are laid or placed upon the said beds, about ten or twelve inches asunder; and the whole are covered over with moss, taken from the intervals which are thus converted into ditches, to be followed by another covering about the time the potato plants begin to make their appearance, the covering in the whole amounting to about four or five inches: at the same time the division furrows are cleaned out to cover the sets that are contiguous to them. The whole field is thus divided into spaces or lazy beds, like a chequered board. During summer, they cut the moss with hoes, and draw it up a little towards the stems of the plants. Few weeds appear, except what are conveyed by the dung. This is the practice universally followed when potatoes are planted on moss for the first time; but after the moss is finely pulverised and reduced, they either plant them in rows across the ridges, or plant and dress them with the plough in the usual manner.

"Potatoes planted as the first crop never misgive, and they are the best and most certain method at once to reclaim a moss, not owing so much perhaps to the dung aiding the putrid fermentation which the lime has already excited, as to their roots pushing and dividing the moss, while the leaves shelter it from the sun, cause a stagnation of air, and thus keep it in that degree of moisture which is most favourable to the action of lime upon moss. The practice of making potatoes the first crop is now universally followed, in so far as the farmers can command dung. The produce is from 40 to 60 bolls per acre, the potato measure being eight Winchester bushels a little heaped to the boll. Mosses that are fully reclaimed yield from 60 to 70 bolls of potatoes at an average, and in some places where manures are abundant, they have been known to yield from 80 to 100 bolls per acre, of the above measure.

"Mr Smith is about to try yams upon his mosses, from the opinion that prevails among some of the Mid-Lothian farmers, where this plant is much cultivated, that they require little or no dung, and that the superior breadth of their leaves, will prove more favourable than those of potatoes, for sheltering the ground.

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Preparation of Land. "When the potato crop is removed, the ridges are again put into their original form; in doing which, care is taken to preserve the mould that is acquired uppermost; this is done by moving the subfurrow on each side with a strong spade, half way into the intermediate ditch from which the lazy beds were covered, and scattering the mould equally over the whole surface. This operation costs 18s. per acre. It is not easy to calculate the expence of planting the potatoes forming the lazy beds, &c. as this is seldom executed by contract; but the lazy beds being thus reduced, the land is ready for a crop of corn.

"Though a crop of oats frequently misgives upon moss that has been but recently limed, yet in other cases, where the lime has lain several months upon the land, it proves a good crop, and is sufficient to cover all the expence with a little profit. The crops of succeeding years are sufficient to afford from their straw putrescent manure for such land in order that it may be cleaned with potatoes, and prepared for grass seeds.

"But after potatoes of the first year, with the slight operation of reducing the lazy beds, from 10 to 12 bolls of oats are at an average produced per acre. The oats are excellent, and yield from 18 to 20 pecks of meal per boll; they would sell upon the ground for 10l. or 12l. per acre. The ground continues to yield oats of the same quality for several years, without any apparent diminution of fertility, and without receiving any additional manure: the only apparent bar to the continuance of this crop is, the soil becoming grassy. When the grass begins to contend with the crop for pre-eminence, the land is thrown into pasture, and would let ever after in that state at from 20s. to 25s. per acre. Daisies, white clover, &c. &c. now spring up in mosses, where their existence was never before suspected; at the same time thistles and other weeds for some time infest the pasture.

"The better practice is, to take another crop of potatoes with a little dung and lime, and give it a trench-delving, to bury the weeds and bring up new soil; after the potatoes, to sow barley and grass seeds.

"Rye-grass is universally sown here, and it attains amazing perfection upon moss properly prepared; along with this, white and yellow clover are sometimes sown, and thrive remarkably well. Red clover has been tried, but did not succeed, and is hence discredited for moss-lands: perhaps it may have been unjustly censured, because it is certain that the seasons in which it was tried, proved very unfavourable to red clover in all parts of the country, most of it having died during winter.

"5. We have already described the levelling of the lazy beds. All future delvings of the moss are performed from one end of the ridge to the other; by this method the slices that had been cut and turned over in the first operation of forming the ridge, are again cut across, and constantly reduced into smaller pieces, till they moulder into earth.

"The expence of delving a moss for the first time, where the surface is tolerably smooth, is 2½d. per fall, or 1l. 13s. 4d. per Scots acre; but where inequalities occur, which must be thrown down by the spade into hollows, it costs about 2l. per acre. If there be eminences, which must be removed into hollows by wheelbarrows running upon boards, the first expence is great-

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er according to circumstances. The second delving, where potatoes have not intervened, costs from 1l. to 1l. 6s. per Scots acre, the division-furrows being at the same time cleaned out. The third delving and cleaning of the division furrows costs 1l. per acre; but the moss is now so friable, that it may be wrought with the greatest ease and rapidity. At the above rates, an ordinary workman will earn 1s. 6d. per day, and an able and experienced one, from that to 2s. 6d. per day. They use a strong spade, edged with steel, and have always a gritstone near them for sharpening the spade. In the evening they repair its edge upon a grindstone; and when the steel is worn away, they lay it again with new steel. Sometimes the moss is so soft that they walk upon boards while they are turning it over.

"Mr Smith has found, by long experience, that it is improper to make the ridges too high or too narrow: when they are too high, they throw the water off from their sides without admitting it to penetrate their substance; the top of course gets too dry: when too narrow, there is a loss of surface from too many division-furrows; the breadth already mentioned is found to be the best: and when the improvement is completed, the ridges appear like segments of wide circles, with a clean well defined division-furrow between each of them. The moisture is thus caused slowly to filtrate through the moss rendered friable by lime, until it reaches the division-furrows, and is discharged. As the moss subsides for some time, and closes in towards the furrows, it is generally necessary to clean these out before winter, and at the time the crop is sown, until the moss acquire solidity.

"Some mosses may be ploughed the second year to within two bouts or four slices of the division-furrows, and every operation performed by the force of horses, except turning over with the spade the narrow stripes next to the division-furrows. In other mosses it requires three years before this can be done; and it seldom happens but every moss may be wrought by the plough after it has been wrought four years by the spade. When moss is wrought by the spade, it seems of no consequence whether it be wrought wet or dry; but when it is wrought by the plough, opportunities must be watched, as horses cannot walk upon it for some years during wet weather.

"6. With respect to the quality of the potatoes thus produced upon mosses, I do not scruple to pronounce it most excellent. Potatoes have been tried with dung alone: but they are always watery, and frequently hollow or rotten in the heart: those raised upon mosses that have been well limed, are frequently so dry and farinaceous, that it is difficult to boil them without reducing them to powder; and they are often obliged to lift them with spoons: they come clean out of the ground; keep remarkably well in heaps covered with moss in the field; and are remarkably well flavoured.

"No such disease as the curl was ever known among moss potatoes; and, indeed, if Dr Coventry's opinion be true, that the curl is caused by overloading the sets with too much earth, or from the earth becoming too hard around them, no such thing can take place in moss. But to whatever cause the curl may be owing, it is certainly propagated by diseased seed; it would, therefore, appear advantageous to transfer the potatoes raised upon moss as seed for solid land. They

have a remarkably good species of potato in this district, which was brought from Virginia to Largs about eight years ago; and whether it be owing to the beneficial nature of a mossy soil, or to its own intrinsic merits, this potato has long been so much distinguished by the good quality and large quantity of its produce, that it has superseded the use of every other species. There seems to be no occasion for moss improvers to change their seed. Some persons in this district, who have but small patches of moss, have kept them constantly in potatoes more than ten years, without changing their seed, and without any sensible diminution either in the quantity or quality of the crop."

4. Of bringing LAND into CULTURE from a State of Nature.

To improve a moor, let it be opened, if possible, in winter, when it is wet, which has one convenience, that the plough cannot be employed in any other work. It is always supposed, however, that the moisture has been sufficiently removed by draining, to render this practicable. In spring, after the frost is over, a slight harrowing will fill up the interstices with mould, to keep out the air and rot the sod. Thus it may be suffered to lie during the following summer and winter, which will tend more to rot the turf than if laid open to the air by ploughing. Next April, let it be cross-ploughed, braked, and harrowed, till it be sufficiently pulverized for turnip seed, to be sown broadcast, or in drills, after being manured, and the manure mixed with the soil by repeated harrowings.

It sometimes happens, however, that the heath which grows upon a moorish soil is so strong and vigorous as to be subdued with great difficulty. It has been observed, that after land is drained and the heath burnt upon the surface, this plant is in time extirpated by sheep. These animals are extremely fond of the tender shoots and flowers of heath, but they will not taste it after it runs into seed, unless compelled by extreme hunger. For subduing it by a shorter process, lime is the best remedy, as it seems a mortal enemy to heath. A strong dose of caustic lime therefore laid upon the surface of the land after it is first ploughed, is attended with the best effect in consuming the roots of heath and of coarse grasses, and rendering the soil friable, which it accomplishes in about six months. Economy in the use of this ingredient, therefore, at the first breaking up of moor land, is extremely misapplied. Accordingly some skilful farmers lay one dose of lime upon the land before it is ploughed, and another after it, that the furrow slices, being wholly surrounded by it, may be sooner brought into a friable state. But, although a very considerable dose of lime is absolutely necessary, when such land is newly reduced from a state of nature, it ought not to be solely trusted to. To render the land permanently fertile, it soon becomes necessary to aid the soil, by vegetable or putrescent manure.

The turnip crop may be consumed upon the ground by sheep, which affords an excellent preparation for laying down the field with grass seeds; a point which every improver ought to have in view, on account of the command of dung which it gives him. It is even said to be an improvement upon this method, to take two or even three successive crops of turnips, all consumed

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equal height: the half of the ridge is often covered from the sun, a disadvantage which is far from being slight in a cold climate. High ridges labour under another disadvantage, in ground that has no more level than barely sufficient to carry off water: they sink the furrows below the level of the ground; and consequently retain water at the end of every ridge. The furrows ought never to be sunk below the level of the ground. Water will more effectually be carried off by lessening the ridges both in height and breadth: a narrow ridge, the crown of which is but 18 inches higher than the furrow, has a greater slope than a very broad ridge where the difference is three or four feet.

Next, of forming ridges where the ground hangs considerably. Ridges may be too steep as well as too horizontal: and if to the ridges be given all the steepness of a field, a heavy shower may do irreparable mischief. To prevent such mischief, the ridges ought to be so directed cross the field, as to have a gentle slope for carrying off water slowly, and no more. In that respect, a hanging field has greatly the advantage of one that is nearly horizontal; because, in the latter, there is no opportunity of a choice in forming the ridges. A hill is of all the best adapted for directing the ridges properly. If the soil be gravelly, it may be ploughed round and round, beginning at the bottom and ascending gradually to the top in a spiral line. This method of ploughing a hill requires no more force than ploughing on a level; and at the same time removes the great inconvenience of a gravelly hill, that rains go off too quickly; for the rain is retained in every furrow. If the soil be such as to require ridges, they may be directed to any slope that is proper.

In order to form a field into ridges that has not been formerly cultivated, the rules mentioned are easily put in execution. But what if ridges be already formed, that are either crooked or too high? After seeing the advantage of forming a field into ridges, people were naturally led into an error, that the higher the better. But what could tempt them to make their ridges crooked! Certainly this method did not originate from design; but from the laziness of the driver suffering the cattle to turn too hastily, instead of making them finish the ridge without turning. There is more than one disadvantage in this slovenly practice. First, the water is kept in by the curve at the end of every ridge, and sours the ground. Next, as a plough has the least friction possible in a straight line, the friction must be increased in a curve, the back part of the mouldboard pressing hard on the one hand, and the coulter pressing hard on the other. In the third place, the plough moving in a straight line, has the greatest command in laying the earth over. But where the straight line of the plough is applied to the curvature of a ridge in order to heighten it by gathering, the earth moved by the plough is continually falling back, in spite of the most skilful ploughman.

The inconveniences of ridges high and crooked are so many, that one would be tempted to apply a remedy at any risk. And yet, if the soil be clay, it would not be advisable for a tenant to apply the remedy upon a lease shorter than two nineteen years. In a dry gravelly soil, the work is not difficult nor hazardous. When the ridges are cleaved two or three years successively in the course of cropping, the operation ought

to be concluded in one summer. The earth, by reiterated ploughings, should be accumulated upon the furrows, so as to raise them higher than the crowns: they cannot be raised too high, for the accumulated earth will subside by its own weight. Cross ploughing once or twice, will reduce the ground to a flat surface, and give opportunity to form ridges at will. The same method brings down ridges in clay soil: only let care be taken to carry on the work with expedition; because a hearty shower, before the new ridges are formed, would soak the ground in water, and make the farmer suspend his work for the remainder of that year at least. In a strong clay, we would not venture to alter the ridges, unless it can be done to perfection in one season. On this subject Mr Anderson has the following observations*.

"The difficulty of performing this operation properly with the common implements of husbandry, and the obvious benefit that accrues to the farmer from having his fields level, has produced many new inventions of ploughs, harrows, drags, &c. calculated for speedily reducing the fields to that state; none of which have as yet been found fully to answer the purpose for which they were intended, as they all indiscriminately carry the earth that was on the high places into those that were lower; which, although it may in some cases render the surface of the ground tolerably smooth and level, is usually attended with inconveniences far greater, for a considerable length of time, than that which it was intended to remove.

"For experience sufficiently shows, that even the best vegetable mould, if buried for any length of time so far beneath the surface as to be deprived of the benign influences of the atmosphere, loses its *vis vitæ*, if I may be allowed that expression; becomes an inert, lifeless mass, little fitted for nourishing vegetables; and constitutes a soil very improper for the purposes of the farmer. It therefore behoves him, as much as in him lies, to preserve, on every part of his fields, an equal covering of that vegetable mould that has long been uppermost, and rendered fertile by the meliorating influence of the atmosphere. But, if he suddenly levels his high ridges by any of these mechanical contrivances, he of necessity buries all the good mould that was on the top of the ridges in the old furrows; by which he greatly impoverishes one part of his field, while he too much enriches another; insomuch that it is a matter of great difficulty, for many years thereafter, to get the field brought to an equal degree of fertility in different places; which makes it impossible for the farmer to get an equal crop over the whole of his field by any management whatever: and he has the mortification frequently, by this means, to see the one half of his crop rotted by an over-luxuriance, while other parts of it are weak and sickly; or one part ripe and ready for reaping, while the other is not properly filled; so that it were, on many occasions, better for him to have his whole field reduced at once to the same degree of poorness as the poorest of it, than have it in this state. An almost impracticable degree of attention in spreading the manures may indeed in some measure get the better of this: but it is so difficult to perform this properly, that I have frequently seen fields that had been thus levelled, in which, after thirty years of continued culture and repeated dressings, the marks of the old ridges

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* *Essays on
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"But this is a degree of perfection in levelling that cannot be usually attained by following this mode of practice, and therefore is but seldom seen. For all that can be expected to be done by any levelling machine, is to render the surface perfectly smooth and even in every part, at the time that the operation is performed: but as, in this case, the old hollows are suddenly filled up with loose mould to a great depth, while the earth below the surface upon the heights of the old ridges remains firm and compact, the new raised earth after a short time subsides very much, while the other parts of the field do not sink at all; so that in a short time the old furrows come to be again below the level of the other parts of the field, and the water of course is suffered in some degree to stagnate upon them; insomuch that, in a few years, it becomes necessary once more to repeat the same levelling process, and thus renew the damage that the farmer sustains by this pernicious operation.

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"On these accounts, if the farmer has not a long lease, it will be found in general to be much his interest to leave the ridges as he found them, rather than to attempt to alter their direction; and, if he attends with due caution to moderate the height of these old ridges, he may reap very good crops, although perhaps at a somewhat greater expence of labour than he would have been put to upon the same field, if it had been reduced to a proper level surface, and divided into straight and parallel ridges.

"But, where a man is secure of possessing his ground for any considerable length of time, the advantages that he will reap from having level and well laid out fields, are so considerable as to be worth purchasing, if it should even be at a considerable expence. But the loss that is sustained at the beginning, by this mechanical mode of levelling ridges, if they are of considerable height, is so very great, that it is perhaps doubtful if any future advantages can ever fully compensate it. I would therefore advise, that all this levelling apparatus should be laid aside; and the following more efficacious practice be substituted in its stead: A practice that I have long followed with success, and can safely recommend as the very best that has yet come to my knowledge.

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levelling.

"If the ridges have been raised to a very great height, as a preparation for the ensuing operations, they may be first *cloven*, or *scalded* out, as it is called in different places; that is, ploughed so as to lay the earth on each ridge from the middle towards the furrows. But if they are only of a moderate degree of height, this operation may be omitted. When you mean to proceed to level the ground, let a number of men be collected, with spades, more or fewer as the nature of the ground requires, and then set a plough to draw a furrow directly across the ridges of the whole field intended to be levelled. Divide this line into as many parts as you have labourers, allotting to each one ridge or two, or more or less, according to their number, height, and other circumstances. Let each of the labourers have orders, as soon as the plough has passed that part assigned him, to begin to dig in the

bottom of the furrow that the plough has just made, about the middle of the side of the old ridge, keeping his face towards the old furrow, working backwards till he comes to the height of the ridge; and then turn towards the other furrow, and repeat the same on the other side of the ridge, always throwing the earth that he digs up into the deep old furrow between the ridges, that is directly before him; taking care not to dig deep where he first begins, but to go deeper and deeper as he advances to the height of the ridge, so as to leave the bottom of the trench he thus makes across the ridge entirely level, or as nearly so as possible. And when he has finished that part of the furrow allotted to him that the plough has made in going, let him then go and finish in the same manner his own portion of the furrow that the plough makes in returning. In this manner, each man performs his own task through the whole field, gradually raising the old furrows as the old heights are depressed. And, if an attentive overseer is at hand, to see that the whole is equally well done, and that each furrow is raised to a greater height than the middle of the old ridges, so as to allow for the subsiding of that loose earth, the operation will be entirely finished at once, and never again need to be repeated.

"In performing this operation, it will always be proper to make the ridges, formed for the purpose of levelling, which go across the old ridges, as broad as possible; because the deep trench that is thus made in each of the furrows is an impediment in the future operations, as well as the height that is accumulated in the middle of each of these ridges; so that the fewer there are of these, the better it is. The farmer, therefore, will do well to advert to this in time, and begin by forming a ridge by always turning the plough to the right hand, till it becomes of such a breadth as makes it very inconvenient to turn longer in that manner; and then, at the distance of twice the breadth of this new-formed ridge from the middle of it, mark off a furrow for the middle of another ridge, turning round it to the right hand, in the same manner as was done in the former, till it becomes of the same breadth with it; and then, turning to the left hand, plough out the interval that was left between the two new formed ridges. By this mode of ploughing, each ridge may be made of 40, 50, or 60 yards in breadth, without any great inconvenience; for although some time will be lost in turning at the ends of these broad ridges, yet as this operation is only to be once performed in this manner, the advantage that is reaped by having few open furrows, is more than sufficient to counterbalance it. And, in order to moderate the height that would be formed in the middle of each of these great ridges, it will always be proper to mark out the ridges, and draw the furrow that is to be the middle of each, some days before you collect your labourers to level the field; that you may, without any hurry or loss of labour, clear out a good trench through the middle of each of the old ridges; as the plough, at this time, going and returning nearly in the same track, prevents the labourers from working properly without this precaution.

"If these rules are attended to, your field will be at once reduced to a proper level, and the rich earth that formed the surface of the old-ridges be still kept upon the

Preparation of Land.

Preparation
of Land.

the surface of your field ; so that the only loss that the possessor of such ground can sustain by this operation, is merely the expence of performing it."

He afterwards makes a calculation of the different expences of levelling by the plough and by the spade, in which he finds the latter by far the cheapest method.

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Proper direction
of the ridges.

Let it be a rule to direct the ridges north and south, if the ground will permit. In this direction, the east and west sides of the ridges, dividing the sun equally between them, will ripen at the same time.

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Narrow
ridges an
advantage.

It is a great advantage in agriculture, to form ridges so narrow, and so low, as to admit the crowns and furrows to be changed alternately every crop. The soil nearest the surface is the best ; and by such ploughing, it is always kept near the surface, and never buried. In high ridges, the soil is accumulated at the crown, and the furrows left bare. Such alteration of crown and furrow is easy where the ridges are no more but seven or eight feet broad. This mode of ploughing answers perfectly well in sandy and gravelly soils, and even in loam ; but it is not safe in clay soil. In that soil, the ridges ought to be 12 feet wide, and 20 inches high ; to be preserved always in the same form by casting, that is, by ploughing two ridges together, beginning at the furrow that separates them, and ploughing round and round till the two ridges be finished. By this method, the separating furrow is raised a little higher than the furrows that bound the two ridges. But at the next ploughing, that inequality is corrected by beginning at the bounding furrows, and going round and round till the ploughing of the two ridges be completed at the separating furrow.

6. CLEARING GROUND OF WEEDS.

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Cleaning
harrow.
Plate VIII.
fig. 6.

For this purpose a new instrument termed a *cleaning harrow* has been introduced by Lord Kames, and is strongly recommended (E). It is one entire piece like the first of those mentioned above, consisting of seven bulls, four feet long each, two and one-fourth inches broad, two and three fourths deep. The bulls are united together by sheths, similar to what are mentioned above. The intervals between the bulls being three and three-fourths inches, the breadth of the whole harrow is three feet five inches. In each bull are inserted eight teeth, each nine inches free below the wood, and distant from each other six inches. The weight of each tooth is a pound, or near it. The whole is firmly bound by an iron plate from corner to corner in the line of the draught. The rest as in the harrows mentioned above. The size, however, is not invariable. The cleaning harrow ought to be larger or less, according as the soil is stiff or free.

To give this instrument its full effect, stones of such a size as not to pass freely between the teeth ought to be carried off, and clods of that size ought to be broken. The ground ought to be dry, which it commonly is in the month of May.

In preparing for barley, turnip, or other summer-crop, begin with ploughing and cross ploughing. If the ground be not sufficiently pulverized, let the great

brake be applied, to be followed successively with the 1st and 2d harrows. In stiff soil, rolling may be proper, once or twice between the acts. These operations will loosen every root, and bring some of them to the surface. This is the time for the 3d harrow, conducted by a boy mounted on one of the horses, who trots smartly along the field, and brings all the roots to the surface : there they are to lie for a day or two, till perfectly dry. If any stones or clods remain, they must be carried off in a cart. And now succeeds the operation of the cleaning harrow. It is drawn by a single horse, directed by reins, which the man at the opposite corner puts over his head, in order to have both hands free. In this corner is fixed a rope, with which the man from time to time raises the harrow from the ground, to let the weeds drop. For the sake of expedition, the weeds ought to be dropt in a straight line cross the field, whether the harrow be full or not ; and seldom is a field so dirty, but that the harrow may go 30 yards before the teeth are filled. The weeds will be thus laid in parallel rows, like those of hay raked together for drying. A harrow may be drawn swiftly along the rows, in order to shake out all the dust ; and then the weeds may be carried clean off the field in carts. But we are not yet done with these weeds : instead of burning, which is the ordinary practice, they may be converted into useful manure, by laying them in a heap with a mixture of hot dung to begin fermentation. At first view, this way of cleaning land will appear operose ; but, upon trial, neither the labour nor expence will be found immoderate. At any rate, the labour and expence ought not to be grudged ; for if a field be once thoroughly cleaned, the seasons must be very cross, or the farmer very indolent, to make it necessary to renew the operation in less than 20 years. In the worst seasons, a few years pasture is always under command ; which effectually destroys triennial plants, such as thistles and couch grass.

SECT. III. Culture of particular Plants.

THE articles hitherto insisted on, are all of them preparatory to the capital object of a farm, that of raising plants for the nourishment of man and of other animals. These are of two kinds ; culmiferous and leguminous ; differing widely from each other. Wheat, rye, barley, oats, rye-grass, are of the first kind ; of the other kind are pease, beans, clover, cabbage, and many others.

Culmiferous plants, says Bonnet, have three sets of roots. The first issue from the seed, and push to the surface an upright stem ; another set issue from a knot in that stem ; and a third from another knot, nearer the surface. Hence the advantage of laying seed so deep in the ground as to afford space for all the sets.

Leguminous plants form their roots differently. Pease, beans, cabbage, have store of small roots, all issuing from the seed, like the undermost set of culmiferous roots ; and they have no other roots. A potato and a turnip have bulbous roots. Red clover has a strong

(E) In his *Gentleman Farmer* ; to which performance the practical part of this article is materially indebted.

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articular
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strong tap root. The difference between culmiferous and leguminous plants with respect to the effects they produce in the soil, will be insisted on afterward, in the section concerning rotation of crops. As the present section is confined to the propagation of plants, it falls naturally to be divided into three articles: first, Plants cultivated for fruit; second, Plants cultivated for roots; third, Plants cultivated for leaves.

I. Plants cultivated for FRUIT.

I. WHEAT and RYE.

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allowing
r wheat.

Any time from the middle of April to the middle of May, the fallowing for wheat may commence, the first ploughing having been given before winter. The moment should be chosen, when the ground, beginning to dry, has yet some remaining softness: in that condition, the soil divides easily by the plough, and falls into small parts. This is an essential article, deserving the strictest attention of the farmer. Ground ploughed too wet, rises, as we say, *whole fur*, as when pasture ground is ploughed: when ploughed too dry, it rises in great lumps, which are not reduced by subsequent ploughings; not to mention, that it requires double force to plough ground too dry, and that the plough is often broken to pieces. When the ground is in proper order, the farmer can have no excuse for delaying a single minute. This first course of fallow must, it is true, yield to the barley seed; but, as the barley seed is commonly over the first week of May, or sooner, the season must be unfavourable if the fallow cannot be reached by the middle of May.

As clay soil requires high ridges, these ought to be cleaved at the first ploughing, beginning at the furrow, and ending at the crown. This ploughing ought to be as deep as the soil will admit: and water-furrowing ought instantly to follow; for if rain happen before water-furrowing, it stagnates in the furrow, necessarily delays the second ploughing till that part of the ridge be dry, and prevents the furrow from being mellowed and roasted by the sun. If this first ploughing be well executed, annual weeds will rise in plenty.

About the first week of June, the great brake will loosen and reduce the soil, encourage a second crop of annuals, and raise to the surface the roots of weeds moved by the plough. Give the weeds time to spring, which may be in two or three weeks. Then proceed to the second ploughing about the beginning of July; which must be cross the ridges, in order to reach all the slips of the former ploughing. By cross-ploughing the furrows will be filled up, and water-furrowing be still more necessary than before. Employ the brake again about the 10th of August, to destroy the annuals that have sprung since the last stirring. The destruction of weeds is a capital article in fallowing: yet so blind are people to their interest, that nothing is more common than a fallow field covered with charlock and wild mustard, all in flower, and 10 or 12 inches high. The field having now received two harrowings and two brakings is prepared for manure, whether lime or dung, which without delay ought to be incorporated with the soil by a repeated harrowing and a gathering furrow. This ought to be about the beginning of September, and as soon after as you please the seed may be sown.

As in ploughing a clay soil it is of importance to prevent poaching, the hinting furrows ought to be done with two horses in a line. If four ploughs be employed in the same field, to one of them may be allotted the care of finishing the hinting furrows.

Loam, being a medium between sand and clay, is of all soils the fittest for culture, and the least subject to chances. It does not hold water like clay; and when wet, it dries sooner. At the same time, it is more retentive than sand of that degree of moisture which promotes vegetation. On the other hand, it is more subject to couch grass than clay, and to other weeds.

Beginning the fallow about the first of May, or as soon as barley seed is over, take as deep a furrow as the soil will admit. Where the ridges are so low and narrow as that the crown and furrow can be changed alternately, there is little or no occasion for water-furrowing. Where the ridges are so high as to make it proper to cleave them, water-furrowing is proper. The second ploughing may be at the distance of five weeks. Two crops of annuals may be got in the interim, the first by the brake and the next by the harrow; and by the same means eight crops may be got in the season. The ground must be cleared of couch-grass and knot-grass roots, by the cleaning harrow described above. The time for this operation is immediately before the manure is laid on. The ground at that time being in its loosest state, parts with its grass roots more freely than at any other time. After the manure is spread, and incorporated with the soil by braking or harrowing, the seed may be sown under furrow, if the ground hang so as easily to carry off the moisture. To leave it rough without harrowing has two advantages: it is not apt to cake with moisture, and the inequalities make a sort of shelter to the young plants against frost. But if it lie flat, it ought to be smoothed with a slight harrow after the seed is sown, which will facilitate the course of the rain from the crown to the furrow.

A sandy soil is too loose for wheat. The only chance for a crop is after red clover, the roots of which bind the soil; and the instructions above given for loam are applicable here. Rye is a crop much fitter for sandy soil than wheat; and like wheat, it is generally sown after a summer fallow.

Lastly, Sow wheat as soon in the month of October as the ground is ready. When sown a month more early, it is too forward in the spring, and apt to be hurt by frost; when sown a month later, it has not time to root before frost comes on; and frost spews it out of the ground.

Propagating of wheat by dividing and transplanting its roots.—In the Philosophical Transactions for 1768, we meet with a very important experiment, of which the following is an abstract. On the 2d of June 1766, Mr C. Miller sowed some grains of the common red wheat; and on the 8th of August a single plant was taken up and separated into 18 parts, and each part planted separately. These plants having pushed out several side shoots, by about the middle of September; some of them were then taken up and divided, and the rest of them between that time and the middle of October. This second division produced 67 plants. These plants remained through the winter, and another division of them, made between the middle of March and

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loam for
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Dressing a
sandy soil.

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and the 12th of April, produced 500 plants. They were then divided no further, but permitted to remain. The plants were in general stronger than any of the wheat in the fields. Some of them produced upwards of 100 ears from a single root. Many of the ears measured seven inches in length, and contained between 60 and 70 grains.

The whole number of ears which, by the process above mentioned, were produced from one grain of wheat, was 21,109, which yielded three pecks and three quarters of clean corn, the weight of which was 47lb. 7 ounces; and from a calculation made by counting the number of grains in an ounce, the whole number of grains was about 386,840.

By this account we find, that there was only one general division of the plants made in the spring. Had a second been made, Mr Miller thinks the number of plants would have amounted to 2000 instead of 500, and the produce thereby been much enlarged.

The ground was a light blackish soil, upon a gravelly bottom; and, consequently, a bad soil for wheat. One half of the ground was well dunged, the other half had no manure. There was, however, not any difference discoverable in the vigour, or growth, or produce, of the plants.—It must be evident, that the expence and labour of setting in the above manner by the hand, will render it scarcely practicable upon a large scale so as to be productive of any utility.

There is perhaps no part of Great Britain where this species of grain is cultivated to more perfection than in Norfolk. Mr Marshall informs us, that the species raised in that county is called the *Norfolk red*, and weighs heavier than any other which has yet been introduced, though he owns that its appearance is much against the assertion, it being a long thin grain, resembling rye more than well-bodied wheat. About 15 or 20 years ago a new species was introduced, named the *Kentish cosh*; against which the millers were at first very much prejudiced, though this prejudice is now got over. A remarkable circumstance respecting this grain is, that though upon its introduction into the county the *cosh* or husk be perfectly white, yet such is the power either of the soil or of the mode of cultivation to produce what the botanists call *varieties*, that the grain in question is said to lose every year somewhat of the whiteness of its husks, until they become at last equally red with those of the former kind. The southern and south-eastern parts of the county generally enjoy a stronger and richer soil than the more northerly, and therefore are more proper for the cultivation of that species of grain. In the northern parts are some farms of very light soil, where the farmers sow only a small quantity of wheat; and these light lands are called *barley farms*.

The greatest part of the wheat in Norfolk is sown upon a second year's ley; sometimes it is sown upon a first year's ley; sometimes on a summer fallow; after pease, turnips, or buck harvested or ploughed under. The practice adopted by those who are looked upon as superior husbandmen in the county of Norfolk is as follows: The second year's leys having finished the bullocks, and brought the stock cattle and horses through the fore part of summer, and the first year's leys having been ready to receive his stock, the farmer begins to break up his old land or ley ground by a peculiar mode

of cultivation named *rice-balking*, in which the furrow is always turned toward the unploughed ground, the edge of the coulter passing always close by the edge of the flag last turned. This is done at first with an even regular furrow; opportunity being taken for performing the operation after the surface has been moistened by a summer shower. In this state his summer leys remain until towards the end of harvest, when he harrows and afterwards ploughs them across the balks of the former ploughing, bringing them now up to the full depth of the soil. On this ploughing he immediately harrows the manure, and ploughs it in with a shallow furrow. The effects of this third ploughing are to mix and effectually pulverize the soil and manure; to cut off and pulverize the upper surfaces of the furrows of the second ploughing; and thus, in the most effectual manner, to eradicate or smother the weeds which had escaped the two former ones. Thus it lies until the seed time, when it is harrowed, rolled, sown, and gathered up into ridges of such width as the farmer thinks most proper. Those of six furrows are most common, though some very good farmers lay their wheat land into four-furrow and others into ten-furrow ridges; "which last (says our author) they execute in a style much superior to what might be expected from wheel ploughs." They excel, however, in the six-furrow ploughing; of which Mr Marshall gives a particular account. When ploughing in this manner, they carry very narrow furrows; so that a six-furrow ridge, set out by letting the off-horse return in the first made furrows, does not measure more than three feet eight or nine inches.

When wheat is cultivated after the first year's ley, the seed is generally sown upon the flag or furrow turned over. After pease, one or two ploughings are given; the other parts of the management being the same with that after the second year's ley already mentioned. After buck harvested he seldom gives more than two, and sometimes but one, ploughing. In the former case he spreads his manure on the stubble, and ploughs it in with a shallow furrow; harrows, rolls, sows, and gathers up the soil into narrow work. The manure is in like manner spread on the stubble after once ploughing; and the seed is then sown among the manure, the whole ploughed in together, and the soil gathered up into narrow ridges, as if it had undergone the operations of a fallow. An inconvenience attending this practice is, that the buck which is necessarily shed in harvesting springs up among the wheat, and becomes a weed to it, at the same time that the rooks, if numerous, pull up both buck and wheat, leaving several patches quite bare. This is obviated in a great measure by first ploughing in the manure and self-sown buck with a shallow furrow; in consequence of which the buck vegetates before the wheat.

It is likewise a favourite practice with the Norfolk farmers to raise wheat after buck ploughed under. They plough under the buck by means of a broom made of rough bushes fixed to the fore tackle of the plough between the wheels, which bears down the plant without lifting the wheels from the ground. Sometimes, when the buck is strong, they first break it down with a roller going the same way that the plough is intended to go; afterwards a good ploughman will cover it so effectually that scarce a stalk can be seen. Some-
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Rice-balk-
ing, a parti-
cular mode
of culture,
explained.

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wheat in
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of crops,
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times the surface of the ground is left rough, but it is more eligible to harrow and roll it. The practice of summer fallowing seldom occurs in Norfolk; though sometimes, when the soil has been much worn down by cropping, and overrun by weeds, it is esteemed a judicious practice by many excellent husbandmen, and the practice seems to be daily gaining ground. After turnips the soil is ploughed to a moderate depth, and the seed sown over the first ploughing: but if the turnips be got in early, the weeds are sometimes first ploughed in with a shallow furrow, and the seed ploughed under with a second ploughing, gathering the soil into narrow ridges.

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Norfolk.

With regard to the manuring of the ground for wheat in Norfolk, that which has been recently clayed or marled is supposed to need no other preparation any more than that which has received 15 or 20 loads of dung and mould for turnips; the first year's ley having been teathed in autumn, and the second fed off. Where the soil is good, and the wheat apt to run too much to straw, it is the practice of some judicious farmers to set their manure upon the young clover, thereby depriving the wheat in some degree of its rankness; but it is most common to spread it upon the broken ground; or if the seed be sown upon the turned furrow, to spread it on the turf and plough it under; or to spread it on the ploughed surface, and harrow it in with the seed as a top-dressing. A smaller quantity of manure is generally made use of for wheat than for turnips. From eight to ten cart loads (as much as three horses can conveniently draw) are reckoned sufficient for an acre; three or four chaldrons of lime to one acre, or 40 bushels of soot to the same quantity of ground; or about a ton of rape-cake to three acres.

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In this county they never begin to sow wheat till after the 17th of October, and continue till the beginning of December, sometimes even till Christmas. They give as a reason for this late sowing, that the wheat treated in this manner is less apt to run to straw than when sown earlier. The seed is generally prepared with brine, and candied in the usual manner with lime. The following method of preparing it is said to be effectual in preventing the smut. "The salt is dissolved in a very small quantity of water, barely sufficient for the purpose. The lime is slaked with this solution, and the wheat candied with it in its hottest state, having been previously moistened with pure water." According to our author's observation, the crops of those farmers who use this preparation are in general more free from smut than those who make use of any other.

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The practice of dibbling or setting of wheat has not as yet become general throughout Norfolk, the common broad-cast method being usually followed, except on the Suffolk side of the county. Some few make use of dibbling and fluting rollers; but drilling is almost entirely unknown, notwithstanding the great aptitude of soil for the practice. Ploughing in the seed under furrow is the favourite mode of the Norfolk farmers, and is performed in the following manner: "The land having been harrowed down level, and the surface rendered smooth by the roller, the head ploughman (if at leisure) marks out the whole piece in narrow slips of about a statute rood in width. This he does by hang-

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ing up the plough in such a manner, that no part of it except the heel touches the ground: and this makes a sure mark for the seedsman, which he cannot by any means mistake. In case the ploughs are all employed, the seedsman himself marks the ground, by drawing a piece of wood or other heavy body behind him." Mr Marshall prefers this to the Kentish method of setting up sticks in the form of a lane, as being less liable to produce mistakes.

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In those places where wheat is dibbled, they make use of iron instruments for the purpose. The acting part is an egg-shaped knob, somewhat larger than a pigeon's egg; the smaller end is the point of the dibble, the larger having a rod of iron rising from it about half an inch square, and two feet and a half long; the head being received into a cross piece of wood resembling the crutch of a spade or shovel, which forms the handle. The dibbler uses two of these instruments, one in each hand; and, bending over them, walks backward upon the turned furrows, making two rows of holes in each of them. Those rows are usually made at the distance of four inches from each other: the holes being two and a half or three inches distant, viz. four in each length of the foot of the dibbler. The great art in making these lies in leaving them firm and smooth in the sides, so that the loose mould may not run in to fill them up before the seeds are deposited. This is done by a circular motion of the hand and wrist; making a semi-revolution every stroke; the circular motion beginning as the bit enters, and continuing until it is entirely disengaged from the mould. The operation is not perfect unless the dibbles come out clean and wear bright. It is somewhat difficult to make the holes at equal distances; but more especially to keep the two straight and parallel to each other, some practice being required to guide the instruments in such a manner as to correspond exactly with each other; but though couples have been invented to remedy this inconvenience to keep them at a proper distance, the other method is still found to be preferable. A middling workman will make four holes in a second. One dibbler is sufficient for three droppers; whence one man and three children are called a *set*. The dibbler carries on three flags or turned furrows; going on some yards upon one of the outside furrows, and returning upon the other, after which he takes the middle one; and thus keeps his three droppers constantly employed, and at the same time is in no danger of filling up the holes with his feet. The droppers put in two or three grains of wheat into each hole; but much time and patience is necessary to teach them to perform the business properly and quickly. An expert dibbler will hole half an acre in a day; though one-third of an acre is usually reckoned a good day's work. The seed is covered by means of a bush harrow; and from one bushel to six pecks is the usual quantity for an acre. Notwithstanding the advantages of saving seed, as well as some others which are generally reckoned undeniable, it is here asserted by some very judicious farmers, that dibbling of wheat on the whole is not really a profitable practice. It is particularly said to be productive of weeds unless dibbled very thick: which indeed may probably be the case, as the weeds are thus allowed a greater space to vegetate in. Mr Marshall himself is of opinion, that "the dibbling of wheat ap-

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wheat de-
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against the
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pears to be peculiarly adapted to rich deep soils, on which three or four pecks dibbled early may spread sufficiently for a full crop; whereas light, weak, shallow soils, which have lain two or three years, and have become grassy, require an additional quantity of seed, and consequently an addition of labour, otherwise the plants are not able to reach each other, and the grasses of course find their way up between them, by which means the crop is injured and the soil rendered foul."

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wheat in
the mid-
land di-
strict.

The same author has likewise given an account of the method of cultivating wheat practised in other English counties. In the midland district, including part of Staffordshire, Derbyshire, Warwick, and Leicestershire, we are informed that the species usually sown is that called *Red Lammas*, the ordinary red wheat of the kingdom: but of late a species named the *Essex dun*, similar to the *Kentish white cosh* of Norfolk, and the *Hertfordshire brown* of Yorkshire, has been coming into vogue. Cone-wheat, formerly in use in this district, is now out of fashion. Spring wheat is cultivated with remarkable success, owing principally to the time of sowing; viz. the close of April. Our author was informed by an excellent farmer in these parts, that by sowing early, as in the beginning of March, the grain was liable to be shrivelled, and the straw to be blighted; while that which was sown towards the end of April, or even in the beginning of May, produced clean plump corn. At the time he visited this district, however, it seemed to be fallen into disrepute; though he looks upon it, in some situations, especially in a turnip country, to be eligible. In the ordinary succession in this part of the kingdom, wheat comes after oats; and there is perhaps nine-tenths of the wheat in this district sown upon oat-stubble. Our author has also seen a few examples of wheat being sown upon turf of six or seven years leying; and several others on clover ley once ploughed, as well as some after turnips. The best crops, however, produced in this, or perhaps in any other district, are after summer fallow. The time of sowing is the month of October, little being sown before Michaelmas; and in a favourable season, little after the close of the month. Much seed is sown here without preparation. When any is made use of, it is the common one of brine candied with lime. The produce is full three quarters per acre, sometimes four or five; and one farmer, in the year 1782, had on 50 acres of land together, no less than 45 bushels per acre.

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In the vale
of Glouce-
ster.

In the Vale of Gloucester, the *cone-wheat*, a variety of the *triticum turgidum*, is cultivated, as well as the lammas and spring wheats. It is not, however, the true cone-wheat which is cultivated here, the ears being nearly cylindrical; but our author met with the true species in North-Wiltshire. Beans in this country are the common predecessors of wheat, and sometimes pease; but here the farmers cultivate wheat upon every species of soil. The time of sowing is in November and December, and the seed is thought to be sown in sufficient time if it is done before Christmas. In this country it is thought that late sown crops always produce better than those which are sown early; but Mr Marshall accounts for this by the vast quantity of weeds the latter have to encounter, and which the late sown crops escape by reason of the weakness of vegetation at that time of the year. The produce, however,

throughout the Vale of Gloucester, is but very indifferent.—Setting of wheat is not practised, but hoeing universally.—In harvesting, Mr Marshall observes, that the grain is allowed to stand until it be unreasonably ripe, and that it is bound up into very small sheaves. The practice of making double bands is unknown in this district; so that the sheaves are no bigger than can be contained in the length of single straw. The inconveniences of this method are, that the crop requires more time to stook, load and unload, and stack: the advantages are, that the trouble of making bands is avoided; and that if rainy weather happens to intervene, the small sheaves dry much sooner than the large ones. Here the crop is cut very high, the stubble and weeds being mown off in swaths for litter soon after the crop is cut: and sometimes sold as high as 5s. per acre.—Mr Marshall is at a loss to account for the little quantity produced in this country: it being hardly possible to derive it from the nature of the soil, almost all of it being proper for the cultivation of the grain.

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Remark-
ably small
sheaves.

Among the Cotswold hills of Gloucester the lam- In the Cotswold hills.

mas and cone wheats are sown; and a new variety of the latter was raised not long ago by picking out a single grain of seed from among a parcel. The body is very long and large, but not slightly.—The Cotswold hills are almost proverbial for early sowing of wheat. The general rule is to begin ploughing in July, and sowing the first wet weather in August; so that here the seed-time and harvest of wheat coincide. If, in consequence of this early sowing the blade becomes rank in autumn, it is supposed to be proper to eat it down by putting a large flock of sheep upon it at once. Eating it in spring is considered as pernicious. It is usually weeded with spud-hooks; not hoed, as in the

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Instance of
the good effects of
hoeing
wheat.

Vale. One instance, however, is mentioned by our author, in which a very thin crop full of seed-weeds hoed in autumn with uncommon success, occurred in the practice of a superior manager in this district; as well as others in which wheat has been weeded in autumn with great advantage. He also met with another well authenticated instance of the good effect of cutting mildewed wheat while very green. "A fine piece of wheat being lodged by heavy rains, and being soon after perceived to be infected with the mildew, was cut, though still in a perfectly green state; namely, about three weeks before the usual time of cutting. It lay spread abroad upon the stubble until it became dry enough to prevent its caking in the sheaf; when it was bound and set up in shocks. The result of this treatment was, that the grain, though small, was of a fine colour, and the heaviest wheat which grew upon the same farm that season; owing, no doubt, to the thinness of its skin. What appears much more remarkable, the straw was perfectly bright, not a speck upon it.—In this part of the country, the produce of wheat is superior to that in the Vale; but Mr Marshall is of opinion, that the soil is much more fit for barley than wheat.

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Of cutting
mildewed
wheat very
green.

In Yorkshire, though generally a grass land country, and where of consequence corn is only a secondary concern, yet several kinds of wheat are cultivated, particularly *Zealand*, *Downy Kent*, *Common White*, *Hertfordshire Brown*, *Yellow Kent*, *Common Red*. All these are varieties of winter wheat; besides which they cultivate also the *spring* or *summer wheat*.

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Cultivation
of wheat
Yorkshire

Here

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Observations on raising varieties of plants.

Here our author makes several curious observations concerning the raising of *varieties* of plants. "It is probable, says he, that time has the same effect upon the varieties of wheat and other grains as it has on those of cultivated fruits, potatoes, and other vegetable productions. Thus to produce an early pea, the gardener marks the plants which open first into blossom among the most early kind he has in cultivation. Next year he sows the produce of those plants, and goes over the coming crop in the manner he had done the preceding year, marking the earlier of this early kind. In a similar manner new varieties of apples are raised, by choosing the broadest leaved plants among a bed of seedlings rising promiscuously from pippins. Husbandmen, it is probable, have heretofore been equally industrious in producing fresh varieties of corn; or whence the endless variety of winter wheats? If they be naturally of one species, as Linnæus has deemed them, they must have been produced by climature, soil, or industry; for although nature sports with individuals, the industry of man is requisite to raise, establish, and continue a permanent variety. The only instance in which I have had an opportunity of tracing the *variety* down to the *parent individual*, has occurred to me in this district. A man of acute observation, having, in a piece of wheat, perceived a plant of uncommon strength and luxuriance, diffusing its branches on every side, and setting its closely-surrounding neighbours at defiance; marked it; and at harvest removed it separately. The produce was 15 ears, yielding 604 grains of a strong-bodied liver-coloured wheat, different, in general appearance, from every other variety he had seen. The chaff was smooth, without awns, and of the colour of the grain; the straw stout and reedy. These 604 grains were planted singly, nine inches asunder, filling about 40 square yards of ground, on a clover stubble, the remainder of the ground being sown with wheat in the ordinary way; by which means extraordinary trouble and destruction by birds were avoided. The produce was two gallons and a half, weighing $20\frac{1}{2}$ lb. of prime grain for seed, besides some pounds of seconds. One grain produced 35 ears, yielding 1235 grains; so that the second year's produce was sufficient to plant an acre of ground. What deters farmers from improvements of this nature is probably the mischievousness of birds: from which at harvest it is scarcely possible to preserve a small patch of corn, especially in a garden or other ground situated near a habitation; but by carrying on the improvement in a field of corn of the same nature, that inconvenience is got rid of. In this situation, however, the botanist will be apprehensive of danger from the floral farina of the surrounding crop. But from what observations I have made, I am of opinion his fears will be groundless. No evil of this kind occurred, though the cultivation of the above variety was carried on among *white* wheat. But this need not be brought as an evidence; it is not uncommon here to sow a mixture of red and white wheats together; and this, it is confidently asserted, without impairing even the colour of either of them. The same mode of culture is applicable to the improvement of varieties; which perhaps would be more profitable to the husbandman than raising new ones, and more expeditious."

In Yorkshire the very singular preparation of seed

wheat prevails which we formerly mentioned, viz. the steeping it in a solution of *arsenic*, as a preventive of smut. Marshall was informed by one farmer, that he had made use of this preparation for 20 years with success, having never during that long space of time suffered any sensible injury from smut. Our author seems inclined to believe the efficacy of this preparation; but thinks there may be some reason to apprehend danger in the use of such a pernicious mineral, either through the carelessness of servants, or handling of the seed by the person who sows it. The farmer above mentioned, however, during all the time he used it, never experienced any inconvenience either to himself, the seedsman, or even to the poultry; though these last, we should have thought, would have been peculiarly liable to accidents from arsenicated seed. The preparation is made by pounding the arsenic extremely fine, boiling it in water, and drenching the seed with the decoction. "In strictness, says Mr Marshall, the arsenic should be levigated sufficiently fine to be taken up and washed over with water, reducing the sediment until it be fine enough to be carried over in the same manner. The usual method of preparing the liquor is to boil one ounce of white arsenic, finely powdered, in a gallon of water, from one to two hours: and to add to the decoction as much water or stale urine as will increase the liquor to two gallons. In this liquor the seed is, or ought to be, immersed, stirring it about in such a manner as to saturate effectually the downy end of each grain. This done, and the liquor drawn off, the seed is considered as fit for the seed basket, without being candied with lime, or any other preparation. A bushel of wheat has been observed to take up about a gallon of liquor. The price of arsenic is about sixpence per pound; which, on this calculation, will cure four quarters of seed. If no more than three quarters be prepared with it, the cost will be only a farthing per bushel; but to this must be added the labour of pounding and boiling. Nevertheless, it is by much the cheapest, and perhaps, upon the whole, adds Mr Marshall, the best preparation we are at present acquainted with. In this county it is believed, that a mixture of wheat and rye, formerly a very common crop in these parts, is never affected with mildew; but our author does not vouch for the truth of this assertion.

2. OATS.

As winter-ploughing enters into the culture of oats, we must remind the reader of the effect of frost upon tilled land. Providence has neglected no region intended for the habitation of man. If in warm climates the soil be meliorated by the sun, it is no less meliorated by frost in cold climates. Frost acts upon water, by expanding it into a larger space. Frost has no effect upon dry earth; witness sand, upon which it makes no impression. But upon wet earth it acts most vigorously; it expands the moisture, which requiring more space puts every particle of the earth out of its place, and separates them from each other. In that view, frost may be considered as a plough superior to any that is made, or can be made, by the hand of man: its action reaches the minutest particles; and, by dividing and separating them, it renders the soil loose and friable. This operation is the most remarkable

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Preparation of wheat with arsenic.

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Plants.

tilled land, which gives free access to frost. With respect to clay soil in particular, there is no rule in husbandry more essential than to open it before winter in hopes of frost. It is even advisable in a clay soil to leave the stubble rank; which, when ploughed in before winter, keeps the clay loose, and admits the frost into every cranny.

To apply this doctrine, it is dangerous to plough clay soil when wet; because water is a cement for clay, and binds it so as to render it unfit for vegetation. It is, however, less dangerous to plough wet clay before winter than after. A succeeding frost corrects the bad effects of such ploughing; a succeeding drought increases them.

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oats.

The common method is, to sow oats on new-ploughed land in the month of March, as soon as the ground is tolerably dry. If it continues wet all the month of March, it is too late to venture them after. It is much better to summer-fallow, and to sow wheat in the autumn. But the preferable method, especially in clay soil, is to turn over the field after harvest, and to lay it open to the influences of frost and air, which lessen the tenacity of clay, and reduce it to a free mould. The surface-soil by this means is finely mellowed for reception of the seed; and it would be a pity to bury it by a second ploughing before sowing. In general, the bulk of clay soils are rich; and skilful ploughing, without dung, will probably give a better crop, than unskilful ploughing with dung.

Hitherto of natural clays. We must add a word of carse clays which are artificial, whether left by the sea, or swept down from higher grounds by rain. The method commonly used of dressing carse clay for oats, is not to stir it till the ground be dry in the spring, which seldom happens before the 1st of March, and the seed is sown as soon after as the ground is sufficiently dry for its reception. Frost has a stronger effect on such clays than on natural clay. And if the field be laid open before winter, it is rendered so loose by frost as to be soon drenched in water. The particles at the same time are so small, as that the first drought in spring makes the surface cake or crust. The difficulty of reducing this crust into mould for covering the oat-seed, has led farmers to delay ploughing till the month of March. But we are taught by experience, that this soil ploughed before winter, is sooner dry than when the ploughing is delayed till spring; and as early sowing is a great advantage, the objection of the superficial crusting is easily removed by the first harrow above described, which will produce abundance of mould for covering the seed. The ploughing before winter not only procures early sowing, but has another advantage: the surface-soil that had been mellowed during winter by the sun, frost, and wind, is kept above.

The dressing a loamy soil for oats differs little from dressing a clay soil, except in the following particular, that being less hurt by rain, it requires not high ridges, and therefore ought to be ploughed crown and furrow alternately.

Where there is both clay and loam in a farm, it is obvious, from what is said above, that the ploughing of the clay after harvest ought first to be dispatched. If both cannot be overtaken that season, the loam may be delayed till the spring with less hurt.

Next of a gravelly soil: which is the reverse of clay,

as it never suffers but from want of moisture. Such a soil ought to have no ridges; but be ploughed circularly from the centre to the circumference, or from the circumference to the centre. It ought to be tilled after harvest: and the first dry weather in spring ought to be laid hold of to sow, harrow, and roll; which will preserve it in sap.

The culture of oats is the simplest of all. That grain is probably a native of Britain: it will grow on the worst soil with very little preparation. For that reason, as already noticed, before turnip was introduced, it was always the first crop upon land broken up from the state of nature.

In Norfolk this kind of grain is much less cultivated than barley; and the only species observed by Mr Marshall is a kind of white oat, which grows quickly, and seems to be of Dutch extraction. Oats are cultivated occasionally on all kinds of soils, but more especially on cold heavy land, or on very light, unproductive, heathy soils. They may frequently succeed wheat, or ley ground barley: "but (says our author) there are no established rules respecting any part of the culture of this time-serving crop." The culture of the ground is usually the same with that of barley; the ground generally undergoing a winter fallow of three or four ploughings, though sometimes they are sown after one ploughing. They are more commonly sown above furrow than barley. The seed-time is made subservient to that of barley, being sometimes sooner and sometimes later than barley seed-time: and Mr Marshall observes, that he has sometimes seen them sown in June. The quantity of seed in Norfolk is from four to five bushels per acre; but he does not acquaint us with the produce. He mentions a very singular method of culture sometimes practised in this country, viz. ploughing down the oats after they begin to vegetate, but before they have got above ground; which is attended with great success, even though the ground is turned over with a full furrow. By this method weeds of every kind are destroyed, or at least checked in such a manner as to give the crop an opportunity of getting above them; and the porosity communicated to the soil is excellently well adapted to the infant plants of barley; which probably might frequently receive benefit from this operation.

In the Vale of Gloucester, Mr Marshall observes, that the wild oat is a very troublesome weed, as well as in Yorkshire; and he is of opinion, that it is as truly a native of Great Britain as any other arable weed, and is perhaps the most difficult to be extirpated. It will lie a century in the soil without losing its vegetative quality. Ground which has lain in a state of grass time immemorial, both in Gloucester and Yorkshire, has produced it in abundance on being broken up. It is also endowed with the same seemingly instinctive choice of seasons and state of the soil as other seeds of weeds appear to have. Hence it is excessively difficult to be overcome; for as it ripens before any crop of grain, it sheds its seed on the soil, where the roughness of its coat probably secures it from birds. The only methods of extirpating this plant are fallowing, hoeing, and handweeding, where the last is practicable, after it has shot its panicle.

No oats are cultivated in the Vale of Gloucester; though the wild oats grow everywhere as already said.

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cultivation
of oats.

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Method of
ploughing
down oats.

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Wild oats
the Vale of
Gloucester.

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Oats not
cultivated
in the Vale
of Gloucester.

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Mr Marshall is of opinion that it is better adapted to oats than to barley. The reason he assigns for the preference given to the latter is, that in this part of the country the monks were formerly very numerous, who probably preferred *ale* to *oaten cake*.—He now, however, recommends a trial of the grain on the stronger cold lands in the area of the Vale, as they seldom can be got sufficiently fine for barley. The fodder from oats he accounts much more valuable than that from barley to a dairy country; and the grain would more than balance in quantity the comparative difference in price.

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the Mid-
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In the midland district the *Poland oat*, which was formerly in vogue, has now given place to the *Dutch* or *Friesland* kind. It is constantly sown after turf; one ploughing being given in February, March, or April. The seed-time is the latter end of March and beginning of April, from four to seven bushels an acre; the produce is in proportion to the seed, the medium being about six quarters.

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York-
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In Yorkshire the *Friesland* oats are likewise preferred to the *Poland*, as affording more straw, and being thinner skinned than the latter. The *Siberian* or *Tartarian* oat, a species unnoticed by Linnæus, is likewise cultivated in this country: the *reed* oat is known, but has not yet come into any great estimation. The grain is light, and the straw too reedy to be affected by cattle.

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Oats are particularly cultivated in the western division of the Vale of Yorkshire; where the soil is chiefly a rich sandy loam, unproductive of wheat. Five or six bushels, or even a quarter of oats, are sometimes sown upon an acre; the produce from seven to ten quarters. In this country they are threshed in the open air, and frequently even upon the bare ground, without even the ceremony of interposing a cloth. The reasons assigned for this seemingly strange practice are, that if pigs and poultry be employed to eat up the grain which escapes the broom, there will be little or no waste. Here the market is always very great for new oats, the manufacturing parts of West Yorkshire using principally oat-bread. The only objection to this practice is the chance of bad weather; but there is always plenty of straw to cover up the threshed corn, and it is found that a little rain upon the straw does not make it less agreeable to cattle.

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eriment
black
Pa.
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In an experiment made by Mr Bartley near Bristol, upon black oats, we are informed that he had the prodigious increase of 98½ Winchester bushels from four on the acre: the land was a deep, mellow, sandy loam. It had carried potatoes the former year, and received one ploughing for a winter fallow. Another ploughing was given it in February, and the seed was sown on the 27th and 28th of the month. The success of the experiment was supposed to be owing partly to the early sowing and partly to a good deep tillage.

3. BARLEY.

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This is a culmiferous plant that requires a mellow soil. Upon that account, extraordinary care is requisite where it is to be sown in clay. The land ought to be stirred immediately after the foregoing crop is removed, which lays it open to be mellowed with the frost and air. In that view, a peculiar sort of ploughing has been introduced, termed *ribbing*; by which the

greatest quantity of surface possible is exposed to the air and frost. The obvious objection to this method is, that half of the ridge is left unmoved. And to obviate that objection, the following method is offered, which moves the whole soil, and at the same time exposes the same quantity of surface to the frost and air. As soon as the former crop is off the field, let the ridges be gathered with as deep a furrow as the soil will admit, beginning at the crown and ending at the furrows. This ploughing loosens the whole soil, giving free access to the air and frost. Soon after, begin a second ploughing in the following manner: Let the field be divided by parallel lines cross the ridges, with intervals of thirty feet or so. Plough once round an interval, beginning at the edges, and turning the earth toward the middle of the interval; which covers a foot or so of the ground formerly ploughed. Within that foot plough another round similar to the former; and, after that, other rounds, till the whole interval be finished, ending at the middle. Instead of beginning at the edges, and ploughing toward the middle, it will have the same effect to begin at the middle, and to plough toward the edges. Plough the other intervals in the same manner. As by this operation the furrows of the ridges will be pretty much filled up, let them be cleared and water-furrowed without delay. By this method, the field will be left waving like a plot in a kitchen garden, ridged up for winter. In this form, the field is kept perfectly dry; for beside the capital furrows that separate the ridges, every ridge has a number of cross furrows that carry the rain instantly to the capital furrows. In hanging grounds retentive of moisture, the parallel lines above mentioned ought not to be perpendicular to the furrows of the ridges, but to be directed a little downward, in order to carry rain water the more hastily to these furrows. If the ground be clean, it may lie in that state winter and spring, till the time of seed-furrowing. If weeds happen to rise, they must be destroyed by ploughing, or braking, or both; for there cannot be worse husbandry, than to put the seed into dirty ground.

This method resembles common ribbing in appearance, but is very different in reality. As the common ribbing is not preceded by a gathering furrow, the half of the field is left untilled, compact as when the former crop was removed, impervious in a great measure to air or frost. The common ribbing at the same time lodges the rain-water on every ridge, preventing it from descending to the furrows; which is hurtful in all soils, and poisonous in a clay soil. The *stitching* here described, or *ribbing*, if you please to call it so, prevents these noxious effects. By the two ploughings the whole soil is opened, admitting freely air and frost; and the multitude of furrows lays the surface perfectly dry, giving an early opportunity for the barley-seed.—But further, as to the advantage of this method: When it is proper to sow the seed, all is laid flat with the brake, which is an easy operation upon soil that is dry and pulverized; and the seed-furrow which succeeds, is so shallow as to bury little or none of the surface earth: whereas the stirring for barley is commonly done with the deepest furrow; and consequently buries all the surface soil that was mellowed by the frost and air. Nor is this method more expensive; because the common ribbing must always be followed with a stirring.

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method.

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Advanta-
ges of this
method.

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Manage-
ment of
seed in a
dry season.

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stirring furrow, which is saved in the method recommended. Nay, it is less expensive; for after common ribbing, which keeps in the rain-water, the ground is commonly so soured, as to make the stirring a laborious work.

It is well known that barley is less valuable when it does not ripen equally; and that barley which comes up speedily, must gain a great advantage over seed-weeds. Therefore, first take out about one-third of the contents of the sacks of seed barley or bear to allow for the swelling of the grain. Lay the sacks with the grain to steep in clean water; let it lie covered with it for at least 24 hours. When the ground is very dry, and no likelihood of rain for 10 days, it is better to lie 36 hours. Sow the grain wet from steeping, without any addition. The seed will scatter well, as clean water has no tenacity; only the sower must put in a fourth or a third more seed in bulk than usual of dry grain, as the grain is swelled in that proportion: harrow it in as quickly as possible after it is sown; and though not necessary, give it the benefit of fresh furrow, if convenient. You may expect it up in a fortnight at farthest.

The following experiment by a correspondent of the Bath Society being considered as a very interesting one, is here subjoined.

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Important
experi-
ments on
seed-bar-
ley.

"The last spring (1783) being remarkably dry, I soaked my seed-barley in the black water taken from a reservoir which constantly receives the draining of my dung heap and stables. As the light corn floated on the top, I skimmed it off, and let the rest stand 24 hours. On taking it from the water, I mixed the seed grain with a sufficient quantity of sifted wood-ashes, to make it spread regularly, and sowed three fields with it. I began sowing the 16th, and finished the 23d of April. The produce was 60 bushels per acre, of good clean barley, without any *small* or *green* corn, or weeds, at harvest. No person in this country had better grain.

I sowed also several other fields with the same seed dry, and without any preparation; but the crop, like those of my neighbours, was very poor; not more than twenty bushels per acre, and much mixed with *green* corn and weeds when harvested. I also sowed some of the seed dry on one ridge in each of my former fields, but the produce was very poor in comparison of the other parts of the field."

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Time of
sowing.

Where the land is in good order, and free of weeds, April is the month for sowing barley. Every day is proper from the first to the last.

The dressing loamy soil and light soil for barley, is the same with that described; only that to plough dry is not altogether so essential as in dressing clay soil. Loam or sand may be stirred a little moist: better, however, delay a week or two, than to stir a loam when wet. Clay must never be ploughed moist, even though the season should escape altogether. But this will seldom be necessary; for not in one year of 20 will it happen, but that clay is dry enough for ploughing some time in May. Frost may correct clay ploughed wet after harvest; but when ploughed wet in the spring, it unites into a hard mass, not to be dissolved but by very hard labour.

On the cultivation of this grain we have the following observations by a Norfolk farmer.

The best soil, he observes, is that which is dry and healthy, rather light than stiff, but yet of sufficient tenacity and strength to retain the moisture. On this kind of land the grain is always the best bodied and coloured, the nimblest in the hand, and has the thinnest rind. These are qualities which recommend it most to the maltster. If the land is poor, it should be dry and warm; and when so, it will often bear better corn than richer land in a cold and wet situation.

In the choice of your seed, it is needful to observe, that the best is of a pale lively colour, and brightish cast, without any deep redness or black tinge at the tail. If the rind be a little shrivelled, it is the better; for that slight shrivelling proves it to have a thin skin, and to have sweated in the mow. The necessity of a change of seed by not sowing two years together what grew on the same soil, is not in any part of husbandry more evident than in the culture of this grain, which if not frequently changed, will grow coarser and coarser every succeeding year.

It has generally been thought, that seed-barley would be benefited by steeping; but liming it has, in many instances, been found prejudicial. Sprinkling a little soot with the water in which it is steeped has been of great service, as it will secure the seed from insects. In a very dry seed time, barley that has been wetted for malting, and begins to sprout, will come up sooner, and produce as good a crop as any other.

If you sow after a fallow, plough three times at least. At the first ploughing, lay your land up in small ridges, and let it remain so during the winter, for the frost to mellow it; the second ploughing should be the beginning of February. In March split the ridges and lay the land as flat as possible, at the same time harrowing it fine. But in strong wet lands (if you have no other for barley) lay it round, and make deep furrows to receive the water.

"I have often (continues he), taken the following method with success: On lands tolerably manured, I sowed clover with my barley, which I reaped at harvest; and fed the clover all the following winter, and from spring to July, when I fallowed it till the following spring, and then sowed it with barley and clover as before. Repeating this method every year, I had very large crops, but would not recommend this practice on poor light land.

"We sow on our lightest lands in April, on our moist lands in May; finding that those lands which are the most subject to weeds produce the best crops when sown late.

"The common method is to sow the barley seed broad-cast at two sowings; the first harrowed in once, the second twice; the usual allowance from three to four bushels per acre. But if farmers could be prevailed on to alter this practice, they would soon find their account in it. Were only half the quantity sown equally, the produce would be greater, and the corn less liable to lodge: For when corn stands very close, the stalks are drawn up weak; and on that account are less capable of resisting the force of winds, or supporting themselves under heavy rains.

"From our great success in setting and drilling wheat, some of our farmers tried these methods with barley; but did not find it answer their expectations, except on very rich land.

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Miscellaneous
observations
concerning
the cultivation
of barley.

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"I have myself had 80 stalks on one root of barley, which all produced good and long ears, and the grain was better than any other; but the method is too expensive for general practice. In poor land, sow thin, or your crop will be worth little. Farmers who do not reason on the matter will be of a different opinion; but the fact is indisputable."

When the barley is sowed and harrowed in, he advises that the land be rolled after the first shower of rain, to break the clods. This will close the earth about the roots, which will be a great advantage to it in dry weather.

When the barley has been up three weeks or a month, it is a very good way to roll it again with a heavy roller, which will prevent the sun and air from penetrating the ground to the injury of the roots. This rolling, before it branches out, will also cause it to tiller into a greater number of stalks; so that if the plants be thin, the ground will be thereby filled, and the stalks strengthened.

If the blade grows too rank, as it sometimes will in a warm wet spring, mowing is a much better method than feeding it down with sheep; because the scythe takes off only the rank tops, but the sheep being fond of the sweet end of the stalk next the root, will often bite so close as to injure its future growth.

The county of Norfolk, according to Mr Marshall, is peculiarly adapted to the cultivation of this grain, the strongest soil not being too heavy, and the lightest being able to bear it; and so well versed are the Norfolk farmers in the cultivation of it, that the barley of this country is desired for seed throughout the whole kingdom. It is here sown after wheat or turnips, and in some very light lands, it is sown after the second year's ley. After wheat, the seed time of the latter being finished, and the stubble trampled down with bullocks, the land is ploughed with a shallow furrow for a winter fallow for barley. In the beginning of March the land is harrowed and cross-ploughed; or if it be wet, the ridges are reversed. In April it receives another ploughing lengthwise; and at seed time it is harrowed, rolled, sowed, and the surface rendered as smooth and level as possible. After turnips the soil is broken up as fast as the turnips are taken off; if early in winter by *rice-balking*, a practice already explained; but if late, by a plain ploughing. It is common, if time will permit, to plough three times; the first shallow, the second full, and the third a mean depth; with which last the seed is ploughed in. Sometimes, however, the ground is ploughed only once, and the seed sown above, but more frequently by three ploughings, though, perhaps, the farmer has not above a week to perform them in. After ley, the turf is generally broken by a winter fallow, and the soil treated as after wheat.

This grain is seldom manured for, except when sown after ley, when it is treated as wheat. No manure is requisite after turnips or wheat, if the latter has been manured for. If not, the turnip crop, following immediately, the barley is left to take its chance, unless the opportunity be embraced for winter marling.

Little barley is sown by the Norfolk farmers before the middle of April, and the seed time generally

continues till the middle of May: though this must in some measure depend on the season; which, says Mr Marshall, is more attended to in Norfolk than perhaps in all the world besides." In the very backward spring of 1782, barley was sown in June with success. No preparation is used. It is all sown broadcast, and almost all under furrow; that is, the surface having been smoothed by the harrow and roller, the seed is sown and ploughed under with a shallow furrow; but if the season be wet, and the soil cold and heavy, it is sometimes sown above; but, if the spring be forward, and the last piece of turnips eaten off late, the ground is sometimes obliged to be ploughed only once, and to be sown above; though in this case Mr Marshall thinks it the most eligible management, instead of turning over the whole thickness of the soil, to *two-furrow* it, and sow between. This is done by only skimming the surface with the first plough, sowing the seed upon this, and then covering it with the bottom furrow brought up by the second plough. Three bushels are usually sufficient for an acre.

The barley, as well as the wheat, in Norfolk, is allowed to stand till very ripe. It is universally mown into swath, with a small bow fixed at the heel of the scythe. If it receive wet in the swath in this county, it is not turned, but *lifted*; that is, the heads or ears are raised from the ground, either with a fork or the teeth of a rake, thereby admitting the air underneath the swaths; which will not fall down again to the ground so close as before, so that the air has free access to the under side; and this method of lifting is supposed not to be inferior to that of turning, which requires more labour, besides breaking and ruffling the swaths.

In the Vale of Gloucester the quantity of barley cultivated is very inconsiderable; the only species is the vale of common long-eared barley, *hordeum zeocriton*. In this Gloucester county the grain we speak of is used, on the every year's lands, as a cleansing crop. It is sown very late, viz. in the middle or end of May; sometimes the beginning or even the middle of June. The reason of this is, that the people of the Vale think, that if a week or ten days of fine weather can be had for the operation of harrowing out couch, and if after this a full crop of barley succeed, especially if it should fortunately take a reclining posture, the business of fallowing is effectually done, insomuch that the soil is cleaned to a sufficient degree to last for a number of years. A great quantity of seed is made use of, viz. from three to four bushels to an acre; under the idea, that a full crop of barley, especially if it lodge, smothers all kinds of weeds, couch-grass itself not excepted. Our author acknowledges this effect in some degree, but does not recommend the practice. "If the land (says he) be tolerably clean, and the season favourable, a barley fallow may no doubt be of essential service. But there is not one year in five in which even land which is tolerably clean can be sown in season, and at the same time be much benefited by it for future crops." The barley in this county is all hand-weeded. It is harvested loose, mown with the naked scythe, lies in swath, till the day of carrying, and is cocked with common hay forks. The medium produce is three quarters per acre. Its quality is preferable to that of the hill barley.

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The common long-eared species is sown among the Cotswold hills. It is sown in the latter end of March and beginning of April, in the quantity of three bushels to an acre, producing from 20 bushels to four quarters to an acre; "which, says our author, is a low produce. It must be observed, however, that this produce is from land deficient in tillage; and that barley delights in a fine pulverous tilth."

In the midland district they cultivate two species of barley, viz. the *zeocriton* or common long-eared, and the *distichon* or sprat barley; the latter not being of more than 50 years standing, but the former of much older date. The sprat is the more hardy, and requires to be more early sown; but the long ear yields the better produce. It succeeds wheat and turnips; but on the strong lands of this district, the crop after wheat is much less productive, as well as less certain, than after turnips; which circumstance is likewise observed in Norfolk. It is sometimes also sown with success upon turf. When sown after wheat, the soil is winter fallowed by three ploughings; the first lengthwise in November; the second across in March; the last, which is the seed-ploughing, lengthwise. Between the two last ploughings the soil is harrowed, and the twitch shaken out with forks; after which it is left loose and light to die upon the surface, without being either burnt or carried off. After turnips the soil has commonly three ploughings; the reason of which is, that the turnips being commonly folded off with sheep, the soil, naturally of a close texture, receives a still greater degree of compactness, which it is proper to break down, to render it porous. The seed time is the two last weeks of April and the first of May; from two bushels and a half to three bushels an acre, sometimes even as much as four bushels: the produce very great, sometimes as high as seven or even eight quarters an acre; but the medium may be reckoned from four to four and a half quarters. Mr Marshall remarks, that the culture of barley is extremely difficult. "Something, says he, depends on the nature of the soil, much on the preparation, much on the season of sowing, and much on harvesting. Upon the whole, it may be deemed, of corn crops, the most difficult to be cultivated with certainty."

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In Yorkshire there are four kinds of barley cultivated, viz. the *zeocriton* or long-eared; the *distichon* or sprat; the *vulgare*, big, four-rowed or spring barley; and the *hexastichon*, six-rowed or spring barley. The first and third sorts are principally cultivated; the winter barley is as yet new to the district. Battledoor barley was formerly very common, but is now almost entirely disused. Mr Marshall observes, that less than a century ago, barley was not saleable until it was malted; there were neither maltsters nor public houses, but every farmer malted his own grain, or sold it to a neighbour who had a malt kiln. Brakes cut from the neighbouring commons were the fuel commonly used upon this occasion; and a certain day for cutting them was fixed, in order to prevent any one from taking more

than his share. The case is now totally reversed, even public malt-houses being unknown, and the business of malting entirely performed by maltsters, who buy the barley from the farmer, and sell him what malt he may want for his family.

To give some idea of the importance of this grain, we shall here state the amount of the revenue which the public draws from an acre of land when cultivated for barley, independent altogether of the profits reaped from it by the landlord and tenant. Supposing an acre to produce eight bolls of barley, and the whole to be made into ordinary small beer, the taxes paid by it stand thus in 1802.

	L.	s.	d.
8 bolls of barley made into malt, allowing 7 bushels per boll, at 1s. 7½d. per bushel of malt duty		4	12 2
The whole may produce 40 barrels of small beer, the duty upon each of which is 2s.		4	0 0
Borough impost, which is imposed in Scotland, but not in England, at 1s. 3d. per barrel		2	10 0
	L. 11	2	2

4. BUCK-WHEAT.

The uses of this plant have already been sufficiently noticed. It delights in a mellow sandy soil; but succeeds well in any dry loose healthy land, and moderately so in a free loamy stone brash. A stiff clay is its aversion, and it is entirely labour lost to sow it in wet poachy ground. The proper season for sowing is from the last week of May or the beginning of June. It has been sown, however, so early as the beginning of April, and so late as the 22d of July, by way of experiment; but the latter was rather extreme to be chosen, and the former was in danger from frost. In an experiment upon a small piece of ground, the grain of two different crops was brought to maturity in the summer 1787.—After spring feedings, a crop of turnip-rooted cabbage, or vetches, there will be sufficient time to sow the land with buck-wheat. Probably, in hot dry summers, a crop of vetches might even be mown for hay early enough to introduce a crop of this grain after it.

In the year 1780, about seven acres of a sandy soil on Brislington common (F), having been first tolerably well cleansed from brambles, furze, &c. received one ploughing. To reduce the irregularities of the surface, it was rolled; and on the 9th of June in that year, two bushels and a half of buck-wheat per acre sown, this ground rolled again without harrowing.

The vegetation appeared in five or six days, as is constantly the case, be the weather wet or dry. The growth was so rapid, that the fern with which this land greatly abounded, was completely kept under. About the middle of September the crop was mown; but

(F) A very rough piece of land at that time just enclosed.

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but by reason of a great deal of rain about that time, it was not secured until the beginning of October; hence a loss of a great part of the grain by shedding, as well as some eaten by birds. However, there were saved about 24 Winchester bushels per acre; and, notwithstanding its long exposure to the weather, received no sort of damage, only perhaps that the finest and most perfect grain was the first to fall from the plant. The ground after this had almost the appearance of a fallow, and was immediately ploughed.

When it had lain a moderate time to meliorate, and to receive the influences of the atmosphere, it was harrowed, sown with Lammas wheat, and ploughed in under furrow, in a contrary direction to the first ploughing. Thus a piece of land, which in the month of April was altogether in a state of nature, in the following November was seen under a promising crop of what is well styled the king of grain, and this without the aid of manure, or of any very great degree of tillage. Nor was the harvest by any means deficient; for several persons conversant in such things estimated the produce from 26 to 30 bushels per acre. As soon as the wheat crop was taken off, the ground had one ploughing, and on the first of September following was sown with turnip seed. The turnips were not large, but of an herbage so abundant, as in the following spring to support 120 ewes with their lambs, which were fed on it by folding four weeks. After this it was manured with a composition of rotten dung and natural earth, about 20 putt loads per acre, and planted with potatoes. The crop sold for 138l. besides a considerable number used in the family, and a quantity reserved with which ten acres were planted the following season. The ensuing autumn it was again sown with wheat, and produced an excellent crop. In the spring of 1784, it was manured and planted with potatoes, as in the preceding instance; the crop, (though tolerably good) by no means equal to the former, producing about 100 sacks per acre only. In spring 1785, the land was now for a third time under a crop of wheat, it being intended to try how far this mode of alternate cropping, one year with potatoes and another with wheat, may be carried.

From the success of the preceding and other experiments, by Nehemiah Bartley, Esq. of Bristol, as detailed in the Bath Society Papers, it would seem, that the culture of this plant ought in many cases to be adopted instead of a summer fallowing: for the crop produced appears not only to be so much clear gain in respect to such practice, but also affords a considerable quantity of straw for fodder and manure.

5. PEASE.

Pease are of two kinds; the white and the gray. The cultivation of the latter only belongs to this place.

There are two species of the gray kind, distinguished by their time of ripening. One ripens soon, and for that reason is termed *hot seed*: the other, which is slower in ripening, is termed *cold seed*.

Pease, a leguminous crop, is proper to intervene between two cerealiferous crops; less for the profit of a pease crop than for meliorating the ground. Pease, however, in a dry season, will produce six or seven

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bolts each acre; but, in an ordinary season, they seldom reach above two, or two and a half. Hence, in a moist climate, which all the west of Britain is, red clover seems a more beneficial crop than pease.

A field intended for cold seed ought to be ploughed in October or November; and in February, as soon as the ground is dry, the seed ought to be sown on the winter furrow. A field intended for hot seed ought to be ploughed in March or April, immediately before sowing. But if infested with weeds, it ought to be also ploughed in October or November.

Pease laid a foot below the surface will vegetate; but the most approved depth is six inches in light soil, and four inches in clay soil; for which reason, they ought to be sown under furrow when the ploughing is delayed till spring. Of all grain, beans excepted, they are the least in danger of being buried.

Pease differ from beans, in loving a dry soil and a dry season. Horse-hoeing would be a great benefit, could it be performed to any advantage; but pease grow expeditiously, and soon fall over and cover the ground, which bars ploughing. Horse-hoeing has little effect when the plants are new sprung; and when they are advanced to be benefited by that culture, their length prevents it. Fast growing at the same time is the cause of their carrying so little seed: the seed is buried among the leaves; and the sun cannot penetrate to make it grow and ripen. The only practicable remedy to obtain grain, is thin sowing; but thick sowing produces more straw and mellow the ground more. Half a boll for an English acre may be reckoned thin sowing; three firlots thick sowing.

Notwithstanding what is said above, Mr Hunter, a noted farmer in Berwickshire, began some time ago to sow all his pease in drills; and never failed to have great crops of corn as well as of straw. He sowed double rows at a foot interval, and two feet and a half between the double rows, which admit horse-hoeing. By that method, he had also good crops of beans on light land.

Pease and beans mixed are often sown together, in order to catch different seasons. In a moist season, the beans make a good crop; in a dry season, the pease.

The growth of plants is commonly checked by drought in the month of July; but promoted by rain in August. In July, grass is parched; in August, it recovers verdure. Where pease are so far advanced in the dry season as that the seed begins to form, their growth is indeed checked, but the seed continues to fill. If only in the blossom at that season, their growth is checked a little; but they become vigorous again in August, and continued growing without filling till stopped by frost. Hence it is, that cold seed, which is early sown, has the best chance to produce corn: hot seed, which is late sown, has the best chance to produce straw.

The following method is practised in Norfolk, for sowing pease upon a dry light soil, immediately opened from pasture. The ground is pared with a plough extremely thin, and every sod is laid exactly on its back. In every sod a double row of holes is made. A pea dropt in every hole lodges in the flayed ground immediately below the sod, thrusts its roots horizontally, and has sufficient moisture. This method enabled Norfolk farmers,

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farmers, in the barren year 1740, to furnish white pease at 12s. per boll.

In the Bath Papers, vol. i. p. 148. we have an account of the success of an experiment by Mr Pavier near Taunton, on sowing pease in drills. The scale on which this experiment was made, however, being so small, it would perhaps be rash to infer from it what might be the event of planting a large piece of ground in the same manner. The space was only 16 square yards, but the produce so great, that by calculating from it, a statute acre would yield 600, or at the least 500 pecks of green pease at the first gathering; which, at the high price they bore at that time in the country about Taunton, viz. 16d. per peck, would have amounted to 33l. 6s. 8d. On this the society observe, that though they doubt not the truth of the calculation, they are of opinion, that such a quantity as 500 or 600 pecks of green pease would immediately reduce the price in any country market. "If the above-mentioned crop (say they) were sold only at 9d. per peck, the farmer would be well paid for his trouble." In a letter on the drill husbandry by Mr Whitmore, for which the thanks of the society were returned, he informs us, that drilled pease must not be sown too thin, or they will always be foul: and in an experiment of this kind, notwithstanding careful hoeing, they turned out so foul, that the produce was only eight bushels to the acre.—From an experiment related in the 5th volume of the same work, it appears that pease, however meliorating they may be to the ground at first, will at the last totally exhaust it, at least with regard to themselves. In this experiment they were sown on the same spot for ten years running. After the first two years the crop became gradually less and less, until at last the seed would not vegetate, but became putrid. Strawberries were then planted without any manure, and yielded an excellent crop.

On the Norfolk culture of pease, Mr Marshall makes two observations. "Leys are seldom ploughed more than once for pease; and the seed is in general dibbled in upon the flag of this one ploughing. But stubbles are in general broken by a winter-fallow of three or four ploughings; the seed being sown broad-cast and ploughed in about three inches deep with the last ploughing."—In the Vale of Gloucester they are planted by women, and hoed by women and children, once, twice, and sometimes thrice; which gives the crop, when the soil is sufficiently free from root-weeds, the appearance of a garden in the summer time, and produces a plentiful crop in harvest. The distance between the rows varies from 10 to 14 inches, but 12 may be considered as the medium; the distance in the rows two inches. In the Cheltenham quarter of the district, they set the pease not in continued lines, but in clumps; making the holes eight or ten inches distant from one another, putting a number of pease into each hole. Thus the hoe has undoubtedly greater freedom; all the disadvantage is, that in this case the soil is not so evenly and fully occupied by the roots as when they are disposed in continued lines.—In Yorkshire it is common to sow beans and gray pease together, under the name of *blendings*; and sometimes fitches (probably, says Mr Marshall, a gigantic variety of the *ervum lens*) are sown among beans. Such mixtures are found to aug-

ment the crop, and the different species are easily separated by the sieve.

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6. BEANS.

The properest soil for beans is a moist and deep clay, but they may also be raised upon all heavy soils. They are cultivated in two ways, either in the old way by broad-cast, or, according to the more recent practice, they are drilled in distinct rows. Of each of these we shall give a very short account.

When the mode of cultivating beans by broad-cast ²⁵⁷ is adopted, it is to be observed, that as this grain is early sown, the ground intended for it should be ploughed ^{Culture of beans by broad-cast.} before winter, to give access to the frost and air; beneficial in all soils, and necessary in a clay soil. Take the first opportunity after January, when the ground is dry, to loosen the soil with the harrow first described, till a mould be brought upon it. Sow the seed, and cover it with the second harrow. The third will smooth the surface, and cover the seed equally. These harrows make the very best figure in sowing beans: which ought to be laid deep in the ground, not less than six inches. In clay soil, the common harrows are altogether insufficient. The soil, which has rested long after ploughing, is rendered compact and solid: the common harrows skim the surface: the seed is not covered; and the first hearty shower of rain lays it above ground. Where the farmer overtakes not the ploughing after harvest, and is reduced to plough immediately before sowing, the plough answers the purpose of the first harrow; and the other two will complete the work. But the labour of the first harrow is ill saved; as the ploughing before winter is a fine preparation, not only for beans, but for grain of every kind. If the ground ploughed before winter happen by superfluity of moisture to cake, the first harrow going along the ridges, and crossing them, will loosen the surface, and give access to the air for drying. As soon as the ground is dry, sow without delaying a moment. If rain happen in the interim, there is no remedy but patience till a dry day or two come.

Carse clay, ploughed before winter, seldom fails to cake. Upon that account, a second ploughing is necessary before sowing: which ought to be performed with an ebb furrow, in order to keep the frost-mould as near the surface as possible. To cover the seed with the plough is, with regard to this as well as other grain, expressed by the phrase *to sow under furrow*. The clods raised in this ploughing are a sort of a shelter to the young plants in the chilly spring months.

The foregoing method will answer for loam. And as for a sandy or gravelly soil, it is altogether improper for beans.

Previous to the year 1770, beans were seldom sown ²⁵⁸ in Scotland, unless upon the very rich clays; but since ^{Culture of beans in drills.} that time, by adopting the plan of raising them in drills, or distinct rows, they have been successfully cultivated upon all the heavy loams, and in many farms they now constitute a regular branch of rotation. With very few exceptions, beans are constantly drilled at intervals of from 20 to 27 inches. Of these modes, the last is the most prevalent, because it admits the ground to be ploughed with a horse, in the most sufficient manner. Very little hand-hoeing is given; nor is it required,

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ed, as the kind of land which is best adapted for their growth, and upon which they are commonly sown, has not naturally a tendency to the production of annual weeds, and fine crops of wheat generally follow, provided due attention has been given to working the bean crop. The necessity of summer fallow, which the present high price of labour, and the loss of a year's crop, render an expensive affair to the farmer, is consequently much lessened: for if land is once thoroughly cleaned, and afterwards kept in an alternate course of leguminous and culmiferous crops, it will remain in good order for a considerable number of years.

As beans delight in a moist soil, and have no end of growing in a moist season, they cover the ground totally when sown broad-cast, keep in the dew, and exclude the sun and air: the plants grow to a great height; but carry little seed, and that little not well ripened. This displays the advantage of drilling; which gives free access to the sun and air, dries the ground, and affords plenty of ripe seed.

II. Plants Cultivated for ROOTS.

I. POTATOES.

These, next to the different kinds of grain, may be looked upon as the crop most generally useful for the husbandman; affording not only a most excellent food for cattle, but for the human species also; and they are perhaps the only substitute that could be used for bread with any probability of success. In the answer by Dr Tissot to M. Linguet already mentioned, the former objects to the constant use of them as food; not because they are pernicious to the body, but because they hurt the faculties of the mind. He owns, that those who eat maize, potatoes, or even millet, may grow tall and acquire a large size; but doubts if any such ever produced a literary work of merit. It does not, however, by any means appear, that the very general use of potatoes in our own country has at all impaired either the health of body or vigour of mind of its inhabitants. The question then, as they have already been shown to be an excellent food for cattle, comes to be merely with regard to the profit of cultivating them; and this seems already to be so well determined by innumerable experiments, as well as by the general practice of the country, that no room appears left for doubt.

The choice of soil is not of greater importance in any other plant than in a potato. This plant in clay soil, or in rank black loam lying low without ventilation, never makes palatable food. In a gravelly or sandy soil, exposed to the sun and free air, it thrives to perfection, and has a good relish. But a rank black loam, though improper to raise potatoes for the table, produces them in great plenty; and the product is, as already observed, a palatable food for horned cattle, hogs, and poultry.

The spade is a proper instrument for raising a small quantity, or for preparing corners or other places inaccessible to the plough; but for raising potatoes in quantities, the plough is the only instrument.

As two great advantages of a drilled crop are, to destroy weeds, and to have a fallow at the same time with the crop, no judicious farmer will think of raising potatoes in any other way. In September or October,

as soon as that year's crop is removed, let the field have a rousing furrow, a cross-braking next, and then be cleared of weeds by the cleaning harrow. Form it into three-feet ridges, in that state to lie till April, which is the proper time for planting potatoes. Then lay well digested horse-dung along the furrows, upon which lay the roots at eight inches distance. Cover up these roots with the plough, going once round every row. This makes a warm bed for the potatoes; hot dung below, and a loose covering above, that admits every ray of the sun. As soon as the plants appear above ground, go round every row a second time with the plough, which will lay upon the plants an additional inch or two of mould, and at the same time bury all the annuals; and this will complete the ploughing of the ridges. When the potatoes are six inches high, the plough, with the deepest furrow, must go twice along the middle of each interval in opposite directions, laying earth first to one row, and next to the other. And to perform this work, a plough with a double mould-board will be more expeditious. But as the earth cannot be laid close to the roots by the plough, the spade must succeed, with which four inches of the plants must be covered, leaving little more but the tops above ground; and this operation will at the same time bury all the weeds that have sprung since the former ploughing. What weeds arise after must be pulled up with the hand.

In the Bath Society Papers, we have the following practical observations on the culture and use of potatoes, given as the result of various experiments made for five years successively on that valuable root, the growth of which cannot be too much encouraged.

When the potato crop has been the only object in view, the following method is the most eligible.

The land being well pulverized by two or three good harrowings and ploughings, is then manured with 15 or 20 cart loads of dung per acre, before it receives its last earth. Then it is thrown into what the Suffolk farmers call the *trench balk*, which is narrow and deep ridge-work, about 15 inches from the centre of one ridge to the centre of the other. Women and children drop the sets in the bottom of every furrow 15 inches apart; men follow and cover them with large hoes, a foot in width, pulling the mould down so as to bury the sets five inches deep; they must receive two or three hand-hoeings, and be kept free from weeds; always observing to draw the earth as much as possible to the stems of the young plants. By repeated trials, the first or second week in April is found the most advantageous time for planting.

In the end of September or the beginning of October, when the haulm becomes withered, they should be ploughed up with a strong double-breasted plough. The workman must be cautioned to set his plough very deep, that he may strike below all the potatoes, to avoid damaging the crop. The women who pick them up, if not carefully attended to, will leave many in the ground, which will prove detrimental to any succeeding corn, whether wheat or barley. To avoid which inconvenience, let the land be harrowed, and turn the swine in to glean the few that may be left by their negligence.

By this method, the sets will be 15 square inches

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from each other; it will take 18 bushels to plant an acre; and the produce, if on a good mixed loamy soil, will amount to 300 bushels.

If the potatoes are grown as a preparation for wheat, it is preferable to have the rows two feet two inches from each other, hand-hoeing only the space from plant to plant in each row; then turning a small furrow from the inside of each row by a common light plough, and afterwards, with a double-breasted plough with one horse, split the ridge formed by the first ploughing thoroughly to clean the intervals. This work should not be done too deep the first time, to avoid burying the tender plants; but the last earth should be ploughed as deep as possible; and the closer the mould is thrown to the stems of the plants, the more advantageous it will prove. Thus 15 bushels will plant an acre, and the produce will be about 300 bushels; but the land, by the summer ploughings, will be prepared to receive seed wheat immediately, and almost ensure a plentiful crop.

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To prevent
the grub.

The potato sets should be cut a week before planting, with one or two eyes to each, and the pieces not very small; two bushels of fresh-slaked lime should be sown over the surface of the land as soon as planted, which will effectually prevent the attacks of the grub.

The expence attending an acre of potatoes well cultivated in the first method, supposing the rent 20 shillings, tithe and town charges rather high (as in Suffolk), taking up, and every thing included, will be about six pounds. In the last method, it would be somewhat reduced.

"When predilections for old customs are subdued (adds the author), I hope to see the potato admitted in the constant course of crops by every spirited husbandman. The most beneficial effects will, I am certain, accrue from such a system. The advantages in my neighbourhood are apparent; I cultivated and fed my own children upon them, and my poorer neighbours sensibly followed the example. A great proportion of every cottager's garden is now occupied by this root, and it forms a principal part of their diet. Potatoes are cheap and excellent substitutes for pease in soups and broths, allowing double the quantity.

263
A cheap
preparation
for the
poor.

"Although it is nearly a transcript of the directions given by a very ingenious author, yet I shall take the liberty of inserting a receipt for making a potato-soup, which I have weekly distributed among the poor to their great relief.

	s.	d.
An ox's head	2	9
Two pecks of potatoes	0	6
Quarter of a peck of onions	0	3
Three quarters of a pound of salt	0	1
An ounce and a half of pepper	0	3
Total	3	10

Ninety pints of water to be boiled with the above ingredients on a slow fire until reduced to 60, which requires one peck of coals, value threepence. I have added the expence of every article, according to their prices with me, that gentlemen may clearly perceive at how easy a rate they can feed 60 of their poor neighbours. I find from experience, a pint of this soup, with a small piece of the meat, is sufficient to satisfy a hear-

ty working man with a good meal. If vegetables are plentiful, some of every sort may be added, with a few sweet herbs.

Culture of
particular
Plants.

"I hope my inserting the above will not be esteemed improper; though somewhat deviating from the culture of potatoes, it may possibly be a means of rendering them more extensively useful."

A premium having been offered by the above-mentioned society for the cultivation of potatoes by farmers, &c. whose rent does not exceed 40l. per annum, the following methods were communicated, by which those who have only a small spot of ground may obtain a plentiful crop.

First, then, the earth should be dug 12 inches deep, if the soil will allow of it; after this, a hole should be opened about six inches deep, horse dung or long litter should be put therein about three inches thick; this hole should not be more than 12 inches in diameter; upon this dung or litter a potato should be planted whole, upon which a little more dung should be cast, and then earth must be put thereon. In like manner the whole plot of ground must be planted, taking care that each potato be at least 16 inches apart; and when the young shoots make their appearance, they should have fresh mould drawn round them with a hoe; and if the tender shoots are covered, it will prevent the frost from injuring them: they should again be earthed when the shoots make a second appearance, but not be covered, as in all probability the season will then be less severe. A plentiful supply of mould should be given them, and the person who performs this business should never tread upon the plant, or the hillock that is raised round it; as the lighter the earth is, the more room the potato will have to expand. From a single root thus planted, very near 40 pounds weight of large potatoes were obtained, and from almost every other root upon the same plot of ground from 15 to 20 pounds weight; and except the soil be stony or gravelly, 10 pounds or half a peck of potatoes may almost always be obtained from each root, by pursuing the foregoing method. But note, cuttings or small sets will not do for this purpose.

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Methods of
cultivating
potatoes on
small spots.

The second method will suit the indolent, or those who have not time to dig their ground; and that is, where weeds much abound and have not been cleared in the winter, a trench may be opened in a straight line the whole length of the ground, and about 6 inches deep: in this trench the potatoes should be planted about ten inches apart; cuttings or small potatoes will do for this method. When they are laid in the trench, the weeds that are on the surface may be pared off on each side about ten inches from it, and be turned upon the plants; another trench should then be dug, and the mould that comes out of it turned carefully on the weeds. It must not be forgot, that each trench should be regularly dug, that the potatoes may be throughout the plot 10 or 12 inches from each other. They should be twice hoed, and earthed up in rows. And here note, that if cut potatoes are to be planted, every cutting should have two eyes, for though fewer sets will be obtained, there will be a greater certainty of a crop, as one eye often fails or is destroyed by grubs in the earth.

265
Methods of
cultivating
potatoes on
small farms.

Where a crop of potatoes fails in part (as will sometimes be the case in a dry season), amends may still be made by laying a little dung upon the knots of the

straw

Culture of straw or haulm of those potatoes that do appear, and covering them with mould: each knot or joint thus ordered will, if the weather prove wet afterwards, produce more potatoes than the original roots.

From the smallest potatoes planted whole, from four to six pounds at a root were obtained, and some of the single potatoes weighed near two pounds. These were dug in as before mentioned, in trenches where the ground was covered with weeds, and the soil was a stiff loamy clay.

A good crop may be obtained by laying potatoes upon turf at about 12 or 14 inches apart, and upon beds of about six feet wide; on each side of which a trench should be opened about three feet wide, and the turf that comes from thence should be laid with the grassy side downwards upon the potatoes; a spit of mould should next be taken from the trenches, and be spread over the turf; and in like manner the whole plot of ground that is designed to be planted must be treated. And remark, that when the young shoots appear, another spit of mould from the trenches should be strewed over the beds so as to cover the shoots; this will prevent the frost from injuring them, encourage them to expand, and totally destroy the young weeds; and when the potatoes are taken up in the autumn, a careful person may turn the earth again into the trenches, so as to make the surface level: and it will be right to remark, that from the same ground a much better crop of potatoes may be obtained the following year.

For field planting, a good (if not the best) method is to dung the land, which should be once ploughed previous thereto; and when it is ploughed a second time, a careful person should drop the potato plants before the plough in every third furrow at about eight or ten inches apart. Plants that are cut with two eyes are best for this purpose. The reason for planting them at so great a distance as every third furrow, is, that when the shoots appear, a horse-hoe may go upon the two vacant furrows to keep them clean; and after they are thus hoed, they should be moulded up in ridges; and if this crop be taken up about October or November, the land will be in excellent condition to receive a crop of wheat. Lands that are full of twitch or couch-grass may be made clean by this method, as the horse-hoeing is as good as a summer fallow; and if, when the potatoes are taken up, women and children were to pick out such filth, not any traces of it would remain; and by laying it on heaps and burning it, a quantity of ashes would be produced for manure.

After ploughing, none should ever dibble in potatoes, as the persons who dibble, plant, or hoe them, will all tread the ground; by which means it will become so bound, that the young fibres cannot expand, as has been already observed. Good crops have indeed been obtained by ploughing the land twice, and dropping the plants in every other furrow, and by hand-hoeing and earthing them up afterwards as the gardeners do pease; but this method is not equal to the other.

Vacant places in hedge-rows might be grubbed and planted with potatoes, and a good crop might be expected, as the leaves of trees, thorns, &c. are a good manure, and will surprisingly encourage their growth, and gratify the wishes of the planter; who by cultivating such places, will then make the most of his ground,

and it will be in fine order to receive a crop of corn the following year.

Account of the culture, expences, and produce of six acres of potatoes, being a fair part of near seventy acres, raised by John Billingsley, Esq. and for which the premium was granted him in the year 1784.

Culture of particular Plants.
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Method of culture, &c. for which a premium was granted,

EXPENCES.

Ploughing an out stubble in October 1783,				
at 4s. per acre	-	-	L. 1	4 0
Cross-ploughing in March 1784	-	-	1	4 0
Harrowing, 2s. per acre	-	-	0	12 0
180 cart-loads of compost, 3l. per acre	-	-	18	0 0
42 sacks of seed-potatoes (each sack weighing 240lb.) of the white sort	-	-	10	10 0
Cutting the sets, 6d. per sack	-	-	1	1 0
Setting on ridges eight feet wide, (leaving an interval of two feet for an alley) 6d for every 20 yards	-	-	10	12 0
Hoeing at 5s. per acre	-	-	1	10 0
Digging up the two feet interval, and throwing the earth on the plants, at 10s. per acre	-	-	3	0 0
Digging up the crop at 8d. for every 20 yards in length, the breadth being 8 feet	-	-	14	6 0
Labour and expence of securing in pits, wear and tear of baskets, straw, reed, spikes, &c. 10s. per acre	-	-	3	0 0
Rent	-	-	6	0 0
Tithe	-	-	1	10 0
				<hr/>
Profit	-	-	72	9 0
			73	11 0
				<hr/>
			L. 146	0 0

PRODUCE.

600 sacks of best potatoes at 4s.	L. 120	0 0
120 sacks middle-sized, 3s. 6d.	21	0 0
50 of small, 2s.	5	0 0
N. B. Each sack 240lb.		
	<hr/>	<hr/>
	L. 146	0 0

The field on which the above experiment was made, was an out-stubble in the autumn of 1783. In October it was ploughed, and left in a rough state during the winter. In April it was cross-ploughed and harrowed. On the 8th of May the field was marked out into beds or ridges eight feet wide, leaving a space of two feet wide for an alley between every two ridges. The manure (a compost of stable dung, virgin earth, and scrapings of a turnpike road) was then brought on the land, and deposited in small heaps on the centre of each ridge, in the proportion of about thirty cart-loads to each acre. A trench was then opened with a spade, breadth-way of the ridge, about four inches deep; in this trench the potato sets were placed, at the distance of nine inches from each other; the dung was then spread in a trench on the sets, and a space or split of 14 inches in breadth dug in upon them. When the plants were about six inches high, they were carefully hoed, and soon after the two feet intervals between the ridges were dug, and the contents thrown around the young plants. This refreshment, added to the ample manuring previously bestowed, produced such a luxuriance and rapidity of growth, that no weed could show its head.

Culture of
particular
Plants.

267
Best method of taking them up.

268
Of preserving them.

The shortest and most certain method of taking up potatoes, is to plough once round every row at the distance of four inches, removing the earth from the plants, and gathering up with the hand all the potatoes that appear. The distance is made four inches, to prevent cutting the roots, which are seldom found above that distance from the row on each side. When the ground is thus cleared by the plough, raise the potatoes with a fork having three broad toes or claws; which is better than a spade, as it does not cut the potatoes. The potatoes thus laid above ground must be gathered with the hand. By this method scarce a potato will be left.

As potatoes are a comfortable food for the common people, it is of importance to have them all the year round. For a long time, potatoes in Scotland were confined to the kitchen garden; and after they were planted in the field, it was not imagined at first that they could be used after the month of December. Of late years, they have been found to answer even till midsummer; which has proved a great support to many a poor family, as they are easily cooked, and require neither kiln nor mill. But there is no cause for stopping there. It is easy to preserve them till the next crop: When taken out of the ground, lay in the corner of a barn a quantity that may serve till April, covered from frost with dry straw pressed down: bury the remainder in a hole dug in dry ground, mixed with the husks of dried oats, sand, or the dry leaves of trees, over which build a stack of hay or corn. When the pit is opened for taking out the potatoes, the eyes of what have a tendency to push must be cut out; and this cargo will serve all the month of June. To be still more certain of making the old crop meet the new, the setting of a small quantity may be delayed till June, to be taken up at the ordinary time before frost. - This cargo, having not arrived at full growth, will not be so ready to push as what are set in April.

If the old crop happen to be exhausted before the new crop is ready, the interval may be supplied by the potatoes of the new crop that lie next the surface, to be picked up with the hand; which, far from hurting the crop, will rather improve it.

In the Transactions of the Society for the encouragement of Arts, a number of experiments are related by Mr Young on that kind called the *clustered* or *hog potato*, which he strongly recommends as food for the poor in preference to the kidney or other more expensive kinds. The following is the result of the most remarkable of his experiments.

269
Mr Young's experiments on the clustered potato.

In the first week of March 1780, two acres and a quarter of barley stubble were sown with the cluster potato, which appeared on the 23d of May. A sharp frost on the 7th of June turned them as black as they usually are by the frosts of November and December. In time, however, they recovered; and by the end of October produced 876 bushels from the $2\frac{1}{4}$ acres; which, when cleaned, were reduced to 780, or 350 bushels per acre; thus affording, when only valued at 6d. per bushel, a clear profit of 7l. 14s. 4d. per acre. The experiment, however, in his opinion, would have been still more profitable, had it not been for the following circumstances: 1. The soil was not altogether proper. 2. The crop was grievously injured by the frost already mentioned, which, in our author's opi-

nion, retarded the growth for about six weeks. 3. The dung was not of his own raising, but purchased; which cannot but be supposed to make a great difference, not only on account of the price, but likewise of the quality, as happened to be the case at present. He is of opinion, however, that potatoes, at least this kind of them, are an exhausting crop. Having sown the field after this large crop of potatoes with wheat, his neighbours were of opinion that it would be too rank; but so far was this from being the case, that the wheat showed not the least sign of luxuriance, nor the least superiority over the parts adjacent which were sown without dung. He was willing to account for this by the poverty of the dung, and the severe cropping which the ground had undergone while in the possession of the former tenant. In another experiment, however, in which the ground had been likewise exhausted by severe cropping, the succeeding crop of wheat showed no luxuriance; so that the former suspicion of the exhausting quality of the cluster potato was rather confirmed. The ground was a fine turnip loam; but though the produce was even greater than in the former case, viz. 356 bushels from an acre, the profit was much less, viz. only 4l. 15s. 6d. An acre of ley ground was sown at the same time with the turnip loam, but the produce from it was only 200 bushels. Mr Young supposes that the produce would have been greater if the potatoes had been planted with an iron dibble, as the turf, in ploughing, lay too heavy upon the seed. A few rows of other potatoes, planted along with the clustered kind, did not vegetate at all; which shows that the latter have a more powerful vegetative faculty.

Having succeeded so well with his experiments on this kind of potato hitherto, Mr Young determined to try the culture of them upon a larger scale, and therefore, in the year 1782, sowed 11 acres: but being obliged to commit the care of sowing them to an ignorant labourer, his unskilfulness, together with the excessive cold and moisture of that season, so diminished the produce, that he had only a single acre out of the whole. This produced 180 bushels, which yielded of clear profit 4l. 2s. 6d. From this experiment he draws the following conclusions: 1. "That the poor loam, on which these potatoes were sown, will yield a crop of cluster-potatoes, though not of any other kind. 2. That the manure for potatoes ought to be carted and spread upon all soils inclinable to wet before the planting season, either in autumn preceding, or else during a hard frost." In 1783 he succeeded still worse; for having that year sown three acres and a half, the profit did not exceed 1s. 4d. per acre. The produce was about 224 bushels per acre. He gives two reasons for the failure of this crop: 1. The clustered potato thrives best in wet years; but the summer of 1783 was dry and hot. 2. The spring frost, by interrupting the hoeing, not only greatly raised the expences, but very much injured the crop by encouraging the growth of weeds. Barley was sown after the last crop, and produced well: so that our author thinks the potatoes seem to be a better preparation for spring corn than wheat. His experiment in 1784 produced a clear profit of 2l. 0s. 4d.; the produce being 250 bushels per acre. Still, however, an error was committed, by employing an old man and woman to cut the sets, by whose

270
Experiments on a larger scale.

Culture of particular plants.

271 Conclusion favourable the cultivation of this kind.

272 Mr. Marshall's remarks.

273 the curl.

274 Method of raising various kinds from seed.

whose unskillfulness there were many great gaps among the potatoes as they came up; so that, on the whole he reckons that he thus lost from 500 to 800 bushels. On the whole, however, his opinion is favourable to the cluster potato. "With small crops (says he), and at the low rate of value which is produced by consuming them at home, they are clearly proved to be a crop which will pay the expence of manuring, and very ample tillage and hoeing. This is, after all, the chief object of modern husbandry; for if a man can rely upon this potato for the winter consumption for his yard in fattening or keeping hogs, in feeding his horses, and fattening his bullocks, he has made one of the greatest acquisitions that can be desired; since he can do all this upon land much too stiff and wet for turnips; houses his crops before the winter rains come on; and consequently without doing any of that injury to his land which the turnip culture is known to entail, and from which even cabbages are not free. Those who know the importance of winter food on a turnip farm cannot but admit the magnitude of this object on wet soils."

Mr Marshall, in his Rural Economy of Yorkshire, has several very interesting remarks on the potato. Its varieties, he says, are endless and transitory. The rough skinned Russian potato, which was long a favourite of the Yorkshire farmers, he is of opinion has now no longer an existence, more than many others which flourished for a time. "There is some reason to believe (says he) that the disease which has of late years been fatal to the potato crop in this and in other districts, under the name of CURLED TOPS, has arisen from too long a continuance of declining varieties. Be this as it may, it appears to be an established opinion here, that *fresh varieties*, raised from seed, are not liable to that disease." Our author, however, does not look upon this to be a fact absolutely established: though one instance fell under his observation, in which its removal was in all probability owing to the introduction of new varieties. It made its appearance between 40 and 50 years ago, and spread in some degree over the whole kingdom. In some places it continued but a short time, so that its effects are almost forgotten. It is seldom obvious at the first coming up of the plants; but attacks them as they increase in size; the entire top becoming dwarfish and shrivelled as if affected by drought or loaded with insects: they nevertheless live, and increase, though slowly, in size; but the roots are unproductive. Some crops have been almost wholly destroyed by this disease. In Yorkshire the Morelands are in a manner free from it, but the Vale is in some measure infected. Plants procured from the Morelands remain free from it in the Vale the first year; but, being continued, become liable to the disease. Where the attack has been partial, weeding out the diseased plants as they failed, is said to have had a good effect; and it is said the Morelanders got rid of the disease by this means.

In Yorkshire some intelligent husbandmen are acquainted with the method of raising potatoes from seed; which is as follows: "In autumn when the apples are beginning to fall spontaneously, they are gathered by hand, and preserved among sand until the spring, when they are mashed among the sand or among fresh mould; separating the seeds and mixing them

evenly with the mould. As soon as the spring frosts are judged to be over, they are sown in fine garden mould; and as fast as the plants get into rough leaf, and are strong enough to be handled without injury, they are transplanted into another bed of rich mould in rows, which are kept clean during summer. In autumn, bunches of small potatoes are found at the roots of these plants; varying in size, the first year, from a hazel nut to that of a crab. These being planted next spring, produce potatoes of the middle size; but they do not arrive at their fullest bulk until the third or fourth year. Where the use of the stove or the garden frame can be had, this process may be shortened. The seeds being sown within either of these early in the spring, the plants will be fit to be planted out as soon as the frosts are gone; by which means the size of the roots will be much increased the first year, and will in the second rise nearly to perfection."

Another account of the mode of raising potatoes from seed is given by Mr Henry Doby of Woodside Chapel, Allerton, near Leeds. "Take the largest potato apples, of the kind you wish to renew, and string them on a very strong coarse thread, and hang them in a dry warm place till the latter end of February; when breaking them very small, and washing them in several waters, the seed is to be separated from the fleshy part and skins; this done, it should be spread on brown paper; and, when dry, sow it in the beginning of March, or sooner, on a hot-bed, in lines about nine inches asunder, and one third of an inch deep, and very thin: water between the lines frequently, and when the plants are risen a little height, introduce fine rich earth between the lines to strengthen them. They should have air admitted frequently, the better to enable them to bear being removed into the open air as soon as the weather shall be sufficiently temperate. Before they are transplanted, they should be plentifully watered, to make them rise with a large ball at their roots; old rotten horse dung and yellow moss are the best manures; plant them in trenches, as celery was formerly, with a space of four feet between the trenches, and 12 or 14 inches between each plant; as they grow up, draw the earth between the trenches to the stalks, but do not cover their tops. The ground, when brought to a level, should be dug, and the plants earthed until there are pretty deep trenches formed between the lines. With this treatment they will produce the first season from a pound weight to five pounds a plant; and many of the plants considerably more than a hundred potatoes a-piece; the produce of which for ten or twelve years after will be prodigious."

In the 4th volume of the Bath papers, Dr Anderson relates some experiments made on potatoes raised from a pigeon's egg to that of a small pea. On planting these next year, it was invariably found, that the largest potatoes yielded the largest crop; and the same happened the third, when a few showed blossom; but not even these had bulbs equal to what would have been produced by very large potatoes. Whence he concludes, that it is impossible to assign any time in which these seedling potatoes will arrive at what is called *perfection*; but that it must depend very much on the nature of the soil and the culture bestowed upon

Culture of particular plants.

Annals of Agriculture, vol. xix.

275 Dr Anderson's experiments.

Culture of particular Plants.

276
Whether potatoes degenerate.

on them. From the practice of the Yorkshire farmers, however, and even from the experiments of the Doctor himself, it is evident, that potatoes raised in this way will at last grow to the usual size, as during the three years in which his experiments were continued they constantly increased in bulk. Dr Anderson likewise contends, that there is no reason for supposing that potatoes raised from bulbs in the ordinary way degenerate, or require to be renewed by seminal varieties; and he instances the universal practice of Britain and Ireland for a great number of years past. But this may be accounted for from an observation of Mr Marshall's, that varieties of potatoes, like those of corn, are partial to particular soils and situations. Hence, by transplanting all the different varieties of potatoes into all possible soils and situations, as has been done within this last century in the islands of Britain and Ireland, these varieties have continued for a much longer time than they would otherwise have done. In Yorkshire, Mr Marshall tells us, that "the old favourite sorts were driven until some of the individual plants barely produced their seed again." It is evident, therefore, that there is a necessity from time to time of renewing them for seed; though it deserves well to be considered whether it would not be more eligible to choose the seed from a plant in full vigour than from that which is so far degenerated that it can scarce produce its seed. "Potatoes raised from seed (says Mr Marshall) are a miscellany of endless varieties. Sometimes these varieties are planted miscellaneously; sometimes particular varieties are selected. In selecting varieties from seedling potatoes, two things are to be attended to; the intrinsic quality of the potato, and its productiveness. If these two desirable properties can be found in one plant, the choice is determined. To this species of attention and industry we are indebted for the many valuable kinds which have been and now are distributed throughout the island. It is observable, however, that varieties of potatoes, like those of corn, are partial to particular soils and situations. Hence the propriety of husbandmen raising potatoes from seed; as by this means, they obtain, with a degree of moral certainty, a sort adapted to their own particular soils and situations. Whoever has attended closely to the work of taking up potatoes, must have observed the great inequality in the productiveness of individual plants. The difference in the produce of adjoining roots, where no disparity of soil can influence, will sometimes be three or four fold. Hence it is evident, that each variety has its *sub-varieties*; through whose means, it can hardly be doubted the parent variety may be improved, and its continuance be prolonged. Thus the farmer has another mean in his power of improving the quality and productiveness of his potato crop, by improving varieties; or, in other words, selecting sub-varieties, superiorly adapted to his soil and situation."

277
How to obtain an early crop.
Farmer's Magazine, 1802.

Sir Archibald Grant, Baronet, of Monymusk, in a letter to the conductors of the Farmer's Magazine, has recently made known a mode practised by him with a view to the saving of seed, and the obtaining an early crop of potatoes. "In spring 1800, (says that gentleman), from a scarcity of seed, I followed a method sometimes used by gardeners, for forcing early potatoes, pease, and beans, viz. that of planting them out upon a

small dunghill, in order to make them come sooner forward, and afterwards transplanting them into the ground. This I did, after they had upon the dunghill risen to be good plants, and the leaves about an inch long. The dunghill was about three feet broad and 18 inches high, with from 2 to 3 inches of earth upon the top of it, and as long as held about a peck and three quarters of a peck of Aberdeenshire measure (or 32lb. Dutch to the peck) of small potatoes, cut into sets, stuck as close to each other as possible in the rows, and each row about two inches asunder. On the 17th of April, they were put upon the dunghill; on the 2d of May they were in leaf; and on the 14th and 15th of May were planted out into the field; each plant 3 feet asunder each way. On the 12th June, they were earthed with the plough, and were afterwards dressed in the ordinary method. On the 1st Monday of October, being taken up, they produced from 14 to 16 bolls Aberdeen measure. In June I observed, that potatoes which had been planted in the ordinary way in other parts of the parish, in the middle of April, were scarcely appearing above ground when these were so high as to require being earthed up with the plough; so that six weeks were gained in growth by this method."

Culture of particular Plants.

During the late great dearth of all kinds of provisions, a plan was adopted with a view to save for food a part of the potatoes used as seed, which consisted of not cutting them into pieces with one or more eyes in each piece, as usual, but of slightly scooping out the eyes, which in that state were planted while the greater part of the potato was preserved for the use of man or cattle. This mode of planting potatoes was successful with a great number of persons; but in some instances, where the ground was not in an excellent state of preparation, the crop is understood to have been more defective than when the usual mode was adopted of cutting off large pieces of the potato along with the eye. The point, however, about the utility of this mode of practice must still be considered as doubtful or worthy of farther investigation. We are rather disposed to think that the practice of slightly scooping out the eye will not ultimately prove beneficial, because in ordinary cases the plant will be left destitute of due nourishment from the parent root at too early a period of its growth, and before it is completely capable of deriving its subsistence from the soil around it; in the same manner, and for the same reason, that light seed is apt to produce a light crop of grain. This objection may not indeed hold good with regard to potatoes planted on a very fine soil, or upon a hot-bed, for transplanting after the manner adopted by Sir Archibald Grant above mentioned. But on poor lands, where the strength of the young plants is more severely tried, any defect in the size of the root planted will probably always be productive of bad effects.

278
Potatoes planted by scooping out the eyes.

2. TURNIP.

Turnip delights in a gravelly soil; and there it can be raised to the greatest perfection, and with the least hazard of miscarrying. At the same time, there is no soil but will bear turnip when well prepared.

No person ever deserved better of a country, than he who first cultivated turnip in the field. No plant is better fitted for the climate of Britain, no plant prospers better

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Culture of turnip.

Culture of
particular
Plants

Culture of
particular
Plants.

better in the coldest part of it, and no plant contributes more to fertility. In a word, there has not for two centuries been introduced into Britain a more valuable improvement.

Of all roots, turnip requires the finest mould; and to that end, of all harrows frost is the best. In order to give access to frost, the land ought to be prepared by ribbing after harvest, as above directed in preparing land for barley. If the field be not subject to annuals, it may lie in that state till the end of May; otherwise, the weeds must be destroyed by a braking about the middle of April, and again in May, if weeds arise. The first week of June, plough the field with a shallow furrow. Lime it if requisite, and harrow the lime into the soil. Draw single furrows with intervals of three feet, and lay dung in the furrows. Cover the dung sufficiently, by going round it with the plough, and forming the three feet spaces into ridges. The dung comes thus to lie below the crown of every ridge.

280
Seasons
and me-
thod of
sowing.

The season of sowing must be regulated by the time intended for feeding. Where intended for feeding in November, December, January, and February, the seed ought to be sown from the first to the 20th of June. Where the feeding is intended to be carried on to March, April and May, the seed must not be sown till the beginning of July. Turnip sown earlier than above directed, flowers that very summer, and runs fast to seed; which renders it in a great measure unfit for food. If sown much later, it does not apple, and there is no food but from the leaves.

Though by a drill plough the seed may be sown of any thickness; the safest way is to sow thick. Thin sowing is liable to many accidents, which are far from being counterbalanced by the expence that is saved in thinning. Thick sowing can bear the ravage of the black fly, and leave a sufficient crop behind. It is a protection against drought, gives the plant a rapid progress, and establishes them in the ground before it is necessary to thin them.

The sowing turnip broad-cast is common in England, though a barbarous practice. The eminent advantage of turnip is, that, besides a profitable crop, it makes a most complete fallow; and the latter cannot be obtained but by horse-hoeing. Upon that account, the sowing turnip in rows at $2\frac{1}{2}$ feet distance is recommended. Wider rows answer no profitable end, straiter rows afford not room for a horse to walk in.

In swampy ground, the surface of which is best reducing by paring and burning, the seed may be sown in rows with intervals of a foot. To save time, a drill-plough may be used that sows three or four rows at once. Hand-hoeing is proper for such ground; because the soil, under the burnt *stratum* is commonly full of roots, which digest and rot better under ground than when brought to the surface by the plough. In the mean time, while these are digesting, the ashes will secure a good crop.

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Properties
of different
sorts of
turnips.

In cultivating turnips to advantage, great care should be taken to procure a good, bright, nimble, and well-dried seed, and of the best kinds.

The Norfolk farmers generally raise the oval white, the large green-topped, and the red or purple topped kinds, which from long experience they have found to be the most profitable.

The roots of the green-topped will grow to a large

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size, and continue good much longer than others. The red or purple-topped will also grow large, and continue good to the beginning of February; but the roots become hard and stringy sooner than the former.

The green-topped growing more above ground, is in more danger of sustaining injury from severe frosts than the red or purple, which are more than half covered by the soil; but it is the softest and sweetest, when grown large, of any kind. We have seen them brought to table a foot in diameter, and equally good as garden turnips.

Turnips delight in a light soil, consisting of sand and loam mixed; for when the soil is rich and heavy, although the crop may be as great in weight, they will be rank, and run to flower earlier in spring.

Turnip-seed, like that of grain, will not do well without frequent changing. The Norfolk seed is sent to most parts of the kingdom, and even to Ireland: but after two years it degenerates; so that those who wish to have turnips in perfection should procure it fresh every year from Norwich, and they will find their account in so doing. For, from its known reputation, many of the London seedsmen sell, under that character, seed raised in the vicinity of the metropolis, which is much inferior in quality.

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Observa-
tions with
regard to
seed.

When the plants have got five leaves, they should be hoed, and set out at least six inches apart. A month afterward, or earlier, if it be a wet season, a second hoeing should take place, and the plants be left at least nine inches distant from each other, especially if intended for feeding cattle; for where the plants are left thicker, they will be proportionably smaller, unless the land is very rich indeed.

Some of the best Norfolk farmers sow turnips in drills three feet asunder, and at a second hoeing leave them a foot apart in their rows. By this means the trouble and expence of hoeing is much lessened, and the crop is of equal weight as when sown in the common method. The intervals may easily be cleared of weeds by the horse-hoe.

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There has been laid before the Board of Agriculture, the result of some interesting experiments, which we shall here state, that were made by Mr W. Jobson of Turvelaws, with a view to ascertain the comparative merits of the two modes of rearing turnips by drill or broad-cast. The trial was made upon a part of a field of 15 acres sown in the month of June 1797. "The whole field, says Mr Jobson, was in equal tilth, was manured as equally as possible immediately before sowing with rotted fold-yard dung, at the rate of 17 cart loads per acre, each load containing about 28 Winchester bushels; and in order to make the experiment perfectly fair, there were breadths of land of 20 yards each, sown in broad-cast and drills alternately, throughout the whole field. Part of the drills on one-bout ridges, of 27 inches each, with the dung laid immediately underneath, where the row of seed was deposited; the rest of the drills upon a level surface, were sown by Mr Bayley's machine at 21 inches distance. The produce per acre is calculated from the weight of four square perches, or the fortieth part of a statute acre of each, having first cut off the tails, or fibrous part of the root, and thrown them aside, as unfit for food, and then taken the weight of the tops and roots separately.

Communi-
cations to the
Board of
Agricul-
ture, vol. ii.

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Culture of
turnip by
drill and
broad-cast
compared.

Culture of
particular
Plants.

"It is necessary to observe, that this field of turnip was but a middling crop, having been much hurt immediately after the first hoeing, by the *grub* (a small worm which destroys the root), particularly the drilled part of the field, which, having had the plants set out, at the distances at which they were intended to remain before the grub seized them, was on that account rendered too thin and otherwise much injured; notwithstanding which, it was found that those on the one-bout ridges exceeded the others in weight; also, that these parcels of turnips were taken from an inferior (though not the worst) part of the field, and may therefore be deemed to be a pretty fair average of the whole: there were also three other portions weighed, which were taken from a part of the field where the roots were larger, and a fuller crop, with a view to ascertain what might have been expected, had not the grub seized them in the manner described; but unfortunately the paper containing their weight has been lost or mislaid, which puts it out of my power to furnish you with it. There was also an account taken of the number (but not the weight) of loads which were produced upon a few acres of the worst part of the field, which was in favour of the broad-cast, in the proportion of ten of broad-cast to nine of those drills on one-bout ridges, and eight of Mr Bayley's drill.

"From this experiment (though defective from the reason assigned) we have reason to conjecture, though not to form a conclusion, that a heavier crop may be raised by sowing in drills at 27 inches distance with the dung immediately beneath the plants, than in broad-cast or in drills at 21 inches on a level surface: but whether the advantage arises from the situation in which the dung is deposited, or from their having a freer circulation of air, or from both these united, it remains for future and repeated experiments to decide. Notwithstanding this, it will be found, that each of these methods possesses peculiar advantages and disadvantages, according to situations and circumstances; the reasons for which I deduce from the observations

I have made respecting this as well as former crops. Culture of
In the first place, the one-bout ridges I think preferable for early sowing, and eating off, through the particular
winter months, even so late as the month of February, as they are more easily procured for food for cattle in deep snows; also in situations where it is difficult to procure a sufficient number of experienced hoers, those under the drill system can be more easily managed and at less expence, as boys and girls may be readily taught to set out the plants with great regularity in very little time; but turnips under this system are liable to the inconvenience of being more apt to be injured by severe frosts from their high exposure. Another inconvenience I have also observed on wet and heavy lands, more especially with little declivity, that although there should, and possibly may, be a larger crop produced thereby, yet the land will unavoidably be so much poached by carrying them off, that the succeeding crop of corn will be lessened more than the extra value of the turnips will compensate. When it is attempted to raise turnips upon land of this description, it will be found more advantageous to form it into ridges of sufficient height to carry off the water with ease into the water furrows, and of sufficient breadth (suppose fifteen feet) to allow a cart to pass along them freely, without forcing the earth in to choke up these furrows. The turnips may be sown either in broad-cast or in drills, upon the surface of these ridges. If the land is addicted to annual weeds, they will be best in drills, which will expedite the hoeing; but if not, or if they be late in sowing, or if the land be subject to the grub, broad-cast will generally be found to produce a more certain crop, as they can be left so near to each other at the first hoeing as to admit of being thinned, and thereby give the opportunity of taking out unhealthy plants at the subsequent hoeings, and also that they grow more vigorously between the first and second hoeings."

The result of the experiment here alluded to, is stated in the following manner:

COMPARATIVE WEIGHT of six portions of Turnips, which were part of a Field of fifteen acres: the whole of which was Sown in the Month of June 1797, as an experiment between the Drill and Broad-cast systems.

	Time of weighing.	Number upon four square perches.	Weight on four square perches, on the 4 th part of an acre.		Weight per statute acre.	Average weight of each turnip.	Average distance of each turnip.
			ROOTS. Cwt. qr. lb.	TOPS. Cwt. qr. lb.			
N ^o I. Drilled on one-bout ridges, at 27 inches distance.	January	354	8 1 1	1 1 3	19 1 0 20	3 0 $\frac{1}{4}$	16 $\frac{1}{2}$ in. by 27 in.
II. Drilled with Mr Bayley's machine, on a level surface, at 21 inches distance.	ditto	428	7 1 15 $\frac{1}{4}$	1 1 5 $\frac{1}{4}$	17 7 1 8	2 4 $\frac{1}{4}$	17 in. by 21 in.
III. Broad-cast.	do.	568	7 2 12 $\frac{1}{2}$	1 0 11 $\frac{1}{4}$	17 8 1 26	1 11 $\frac{1}{2}$	16 $\frac{1}{4}$ each way.
IV. Drilled on one-bout ridges, at 27 inches distance.	Mar. 2.	334	8 3 0	1 1 22	20 7 3 12	3 6 $\frac{1}{2}$	17 by 27 in.
V. Broad-cast. These and the preceding were round white turnips.	do.	628	8 2 22	1 1 8	20 0 2 24	1 11 $\frac{1}{2}$	16 each way.
VI. Broad-cast (Red)	do.	561	6 3 26 $\frac{1}{4}$	2 3 5	19 11 1 0	1 15 $\frac{1}{4}$	16 $\frac{1}{2}$ each way.

"By

Culture of
particular
Plants.

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"By noting the average distance of each turnip, as is done in the last column, is intended to show, at one view, how many plants there were wanting in the drills to have made them a full crop; for, if 550 be stated as a medium number in a full crop, upon the 40th part of an acre, they will be found to occupy a space of 17 inches each way in broad-cast, $10\frac{1}{2}$ by 27 inches on the one-bout ridges, and $13\frac{1}{2}$ by 21 inches of those drilled on the level surface; from whence may be easily seen, how much those were wider in the rows than they ought to have been."

Great quantities of turnips are raised in Norfolk every year for feeding black cattle, which turn to great advantage.

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Value as
food for
cattle.

It is well known, that an acre of land contains 4840 square yards, or 43,560 square feet; suppose then that every square foot contains one turnip, and that they weigh only two pounds each on an average, here will be a mass of food, excellent in kind, of 46 tons per acre, often worth from four to five guineas, and sometimes more.

Extraordinary crops of barley frequently succeed turnips, especially when fed off the land. In feeding them off, the cattle should not be suffered to run over too much of the ground at once, for in that case they will tread down and spoil twice as many as they eat. In Norfolk, they are confined by hurdles to as much as is sufficient for them for one day. By this mode the crop is eaten clean, the soil is equally trodden, which if light is of much service, and equally manured by the cattle.

A notion prevails in many places, that mutton fattened with turnips is thereby rendered rank and ill tasted; but this is a vulgar error. The best mutton in Norfolk (and few counties have better) is all fed with turnips. It is by rank pastures, and marshy lands, that rank mutton is produced.

If the land be wet and springy, the best method is to draw and carry off your turnips to some dry pasture; for the treading of the cattle will not only injure the crop, but render the land so stiff, that you must be at an additional expence in ploughing.

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Method of
preserving
turnips.

To preserve turnips for late spring feed, the best method, and which has been tried with success by some of the best English farmers, is, to stack them up in dry straw; a load of which is sufficient to preserve 40 tons of turnips. The method is easy, and is as follows:—

After drawing your turnips in February, cut off the tops and tap roots (which may be given to sheep), and let them lie a few days in the field, as no weather will then hurt them.

Then, on a layer of straw next the ground, place a layer of turnips two feet thick; and then another layer of straw, and so on alternately, till you have brought the heap to a point. Care must be taken to turn up the edges of the layers of straw, to prevent the turnips from rolling out; cover the top well with long straw, and it will serve as a thatch for the whole.

In this method, as the straw imbibes the moisture exhaled from the roots, all vegetation will be prevented, and the turnips will be nearly as good in May as when first drawn from the field. If straw be scarce, old haulm or stubble will answer the same purpose.

But to prevent this trouble and expence, perhaps

farmers in all counties would find it most to their interest to adopt the method used by our neighbours the Norfolk farmers, which is, to continue sowing turnips to the latter end of August; by which means their late crops remain good in the field till the latter end of April, and often till the middle of May.

The advantages of having turnips good till the spring seed is generally ready, are so obvious, and so great, that many of the most intelligent farmers (although at first prejudiced against the practice) are now come into it, and find their account in so doing.

The greatest disadvantage which attends a crop of turnips, is their being so ready to be damaged by the fly, which sometimes destroys them so completely, that they must be sown over again two or three times the same season, and even this without any certainty of success. Innumerable methods of avoiding this evil have been projected, which may all be reduced to the following classes: 1. Steeping the seed in certain liquids. 2. Fumigation of the fields with the smoke of certain herbs. 3. Rolling. 4. Strewing soot, lime, ashes, &c. on the surface of the ground. It is very difficult, however, to determine, with any degree of certainty, whether remedies of this kind are effectual or not; because sometimes the turnips are not injured though no precaution has been made use of: and when this happens to be the case, after the use of any supposed preventive, the preservation of the crop is ascribed to the use of that preventive, whether it be really efficacious or not. The virtues of steeps seem to have been fully ascertained by Mr Winter Charlton near Bristol, of whose experiments an account is given in the Transactions of the Society for Encouraging Arts, vol. v. The seeds were of the Dutch kind, sowed on beds in the kitchen garden in drills, about twelve inches distant, an inch and a half deep, on the 11th of May 1786. The beds had been prepared with rotten dung in May 1785, and afterwards sown with cabbages. The quality of the turnips is exhibited in the following table; the best being marked 1; and those of inferior quality, 2, 3, &c. The observations were taken on the 26th of June.

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The fly occasions the great inconvenience in turnip culture.

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Whether steeps for turnip-seed be of any use.

Seed without any preparation,	-	-	1
steeped in train oil flourished extremely,	-	-	
steeped in linseed oil, somewhat inferior,	-	-	1
mixed with soot and water,	-	-	2
with drainings of a dunghill,	-	-	2
with elder and barton draining,	-	-	2
with soot,	-	-	3
with elder leaf juice,	-	-	3
with elder and barton draining, soot	-	-	
being sown over the covered drills,	-	-	3
with ditto, and lime sowed over the	-	-	
drills,	-	-	3
sowed with soot scattered over, and then	-	-	
covered,	-	-	3
with barton draining,	-	-	4
an elder bush drawn over when the	-	-	
plants appeared,	-	-	4
with stale human urine, very few plants	-	-	
appeared,	-	-	
with slaked lime scattered over, and	-	-	
then covered, very few plants ap-	-	-	
peared,	-	-	

Culture of
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Plants.

Seed sowed with elder, barton-draining, and slaked lime, very few plants appeared, with lime and barton draining did not vegetate.

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particular
Plants.

Another set of experiments was made with the green Norfolk turnip, drilled an inch and a half deep, the rows one foot distant, on beds eight feet three inches long, and two feet wide; half a drachm of seed allowed for each bed, steeped and mixed with various substances like the former. The seeds were drilled upon unmanured ground on the 20th of June 1786, and the observation made on the 17th of July. None of the beds were found free from the ravages of the fly; but the seed which had been steeped in train oil and linseed oil were much more free from this injury than the others. The linseed oil, as in the former experiment, was found inferior to the train oil, which was supposed to have been owing to its being kept in a bottle that had formerly held oil of turpentine. The leaves of the steeped seeds were of a much darker green than the others, appeared twice as thick in bulk and luxuriance, and the plants were considerably larger than those of the other kinds. The substances mixed with the rest were soapers ashes, wood ashes, pounded gunpowder, brimstone, slaked lime, soot, barton-draining; sometimes mixed together in various proportions, and sometimes with the addition of a portion of sifted mould.

These experiments show, that no dependence can be had on steeps or mixtures of any kind with the turnip-seed; though the train oil and linseed oil seem greatly to have forwarded the vegetation of the plant. It does not appear that fumigation has ever been tried; nor indeed does it seem easy to be tried in such a manner as might ensure success.—In the fourth volume of the Bath Papers, Mr Gullet of Devonshire gives such directions for performing the operation as he thinks would be productive of success.—In a preceding paper he had explained the good effects of fumigating orchards; but the case with these must be very considerably different from a field of turnips. The trees in an orchard are elevated above the ground, and the smoke naturally ascends, and is blown along their tops: but in fumigating a large field of turnips, it must creep along the ground in such a manner as is by no means agreeable to its nature; and without an excessive degree of labour, as well as a vast quantity of burning materials, there cannot be the least hope of success. Mr Gullet's directions are as follow: "If the turnip-ground be spaded and burnt, or the weeds, &c. burnt without spading, the fumigation thereby may suffice to chase such of the winged tribe from thence as are then there; but in all cases, when the field is ploughed and ready for sowing, let heaps be made at different places and intervals round by the hedges and boundaries of the turnip-ground, and some few scattered through the field; then, as soon as the seed is sown, let the heaps on the windward side and the scattered ones be lighted and kept smothering during the continuance of the wind in that quarter; the less the fire, and the more the smoke, the better. Should the wind happen to shift, those heaps on the quarter it shifts to must then be lighted and kept smothering in like manner; so that during the growth of the tender turnip leaf, and until it becomes rough and out of all

danger, this fumigation and smoke, over and across the field, must be continued from one quarter to the other; which I venture to assert, will effectually deter and prevent any winged insect tribe from approaching the turnip-ground: nay more, if there already, it would most completely drive them from thence, as such delicately formed insects (which can only feed on the most tender leaf) would be ill able to continue long in such a smother of fire and smoke. The consequence is obvious and certain, that if the fly be kept from approaching the field, the turnip-crop is safe; and few, I believe, will disagree with me, that *prevention is better than remedy.*"

Our author does not say that he has ever tried this method with turnips; but lays great stress upon his success in a similar experiment with cabbages, in order to preserve them from the caterpillar. To make the matter more sure, however, he recommends the trailing of a bush of elder over the turnip field at the time of harrowing or brushing in the seed: but this remedy has by numberless experiments been found insignificant, and by those above related seems even to be pernicious: so that whatever good effects we can expect from this method, must depend on the fumigation alone; and even this is attended with very great uncertainties, as has already been observed.

Rolling promises to be of service when the young turnips are attacked by snails, which frequently destroy them; but it cannot be supposed to have much effect in destroying flies, these being too numerous and too minute to be effectually crushed by the roller: and indeed, though this has been frequently recommended, we have no decisive proofs of its having ever been attended with any good effect.

The strewing of soot, lime, ashes, &c. upon the ground, have been determined ineffectual by the experiments already related, at least when applied before the turnips come up; and there seems to be little hope of their proving more effectual even when applied after the crop has appeared above ground. We may argue indeed *a priori* about the taste or smell of soot, lime, &c. being disagreeable to insects; but of this we have no proof: and even though this were the case, the leaf soon emerges from under this covering, or the insects will feed on the under part of the leaves, where these substances cannot lie. It is evident, therefore, that very little can be expected from any of the methods hitherto proposed either by way of cure or prevention. Other methods have been suggested.

One method proposed for securing turnips from the fly, is by sowing such a quantity of seed as will be more than sufficient for the consumpt of the insects. This we find recommended in a letter to the Bath Society, by a gentleman-farmer in Essex, vol. ii. p. 238. His method is to make the land clean and fine as soon as the season will permit, and to sow four pints per acre. It may be objected, that if the fly does not take them, the plants will stand so thick, that they cannot easily be hoed; but this may be obviated by harrowing them first, which will make them fit for the hoe. There can be no expectation of a crop if the fly takes them when only a pint of seed is sown per acre; but this gentleman remarks, that he has not in any one instance missed of a crop when he sowed four pints; because, though the fly has sometimes destroyed more than

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Mr Gullet's directions for fumigation.

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Of rolling.

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Sowing a great quantity of seed.

ture of than one half, and much damaged the other, still there was a sufficient number left behind. He also agrees with other of the Society's correspondents, that the ground should be well dunged and manured previous to the sowing of turnips, as this makes them grow vigorously, so that they quickly get into the rough leaf, in which state the fly will not touch them.

In the same volume, a gentleman of Norfolk remarks, that manuring the ground in autumn for turnips is preferable to the doing so in spring. This discovery he made in consequence of the following accident.—“A neighbouring farmer, not having a sufficient quantity of manure for all his turnip land, was under the necessity of sowing four acres unmanured. The effect was, that the turnips on the manured part of the land were mostly eaten off by the fly, while four acres unmanured escaped without injury.” In consequence of having observed this, the gentleman made a similar experiment, by manuring five acres well for turnips, and tilling three acres and a half in the usual way without any manure. The manured crops were almost all destroyed by the fly, so that he was obliged to sow most of the land over again. The three acres and a half which had no manure were entirely free from injury, though the plants were much smaller than those of the manured ground which came up. Not content with this trial, however, he repeated the experiment by manuring six acres of wheat stubble in autumn, ploughing it in immediately, and leaving it to incorporate with the earth during the winter: the turnips which grew upon this were as large as if the ground had been manured in the spring. This experiment was repeated with surprising success in two succeeding years; whence he infers, that the fly is either engendered in the new dung or enticed by it. But when the manure is laid on in autumn it loses its noxious qualities, though it still retains its nutritive ones.—This conclusion, however, does not appear to be well founded; for it is certain, from undoubted experience, that turnips which have been well manured in the common way, have sometimes escaped any injury; while others, which have got no manure at all, have been almost totally destroyed. Another material advantage, however, which this correspondent observes is to be derived from manuring in autumn is, that all the seeds contained in the manure, and which are of course carried to the land with it, vegetate almost immediately, and are mostly killed by the cold of the succeeding winter, while the few that remain can scarce escape destruction from the ploughshare.

Mr Wimpey is also of opinion, that it is proper to sow a large quantity of seed; but thinks two pounds will be sufficient for an acre. A few ounces indeed would be sufficient to stock the land; but as the article is so precarious, he thinks it by far the safest way to allow seed in plenty, and reduce the plants afterwards by harrowing. He observes also, that it is of great consequence to have seed both good in quality and of the best species. He prefers the large and green topped, as being the most sweet and juicy; others give the preference to the red or purple-topped, as being hardier: but at any rate, the seed from the largest and finest transplanted turnips, of whatever sort, is greatly to be preferred, even though it should cost double or treble the price. Such as is sold by the seedsmen in

London he found generally of a mixed kind, and often in great part not worth cultivating. “Whether plants from new or old seed are most secure from the depredations of the fly (says he), is perhaps a question which cannot be easily determined even by experiments; for concomitant circumstances are frequently so much more operative and powerful, as to render the difference between them, if there be any, imperceptible. It is, however, known to every practical man, that new seed sprouts or vegetates several days before old; and I think more vigorously: and it is equally well known, that the healthy and vigorous plants escape the fly, when the stunted and sickly seldom or never escape it. Hence it would seem, that new seed, *ceteris paribus*, is more secure from the fly than old; and for my own use I would always prefer it.”

In this dissertation on the culture of turnips, we cannot avoid taking notice of an instrument used in Norfolk for transplanting them, and thus filling up the gaps which frequently happen in fields from the failure of the plants in particular spots. It is represented on the margin; and the construction and mode of using are obvious from the figure.—When the turnips are to be transplanted, the workman holds the long handle with the left hand, and the short one with the right hand drawn up. Put the instrument then over the plant that is to be taken up, and with your foot force it into the ground; then give it a twist round, and by drawing it gently up, the earth will adhere to the roots of the plant in a solid body; then with another instrument of the same size take the earth out where the plant is to be put, and bringing the instrument with the plant in it, put it into the hole which has been made by the other; then keep your right hand steady, and draw up your left, and the earth and plant will be left in the hole with the roots undisturbed. In this operation two men will be employed, each of them having an instrument of the form represented on the margin. One man takes up a plant, while the other fills his instrument with earth only, thereby making room for the deposition of the plant; so that the hole which is made by taking up the plant is filled with the earth taken out where the plant is to be put; which being deposited, he takes up a plant, and returns to the place he first set out from, the former man at the same time returning with the earth only; so that each man is alternately the planter, and each being employed both ways, the work goes on briskly.—This instrument was the invention of Mr Cubbit Gray of Southrepps, Norfolk.

Turnips being the grand basis of the Norfolk husbandry, Mr Marshall gives a very particular account of their culture in that county.—The species cultivated are, 1. The common *white stock*, called in many places the Norfolk turnip. 2. The *purple stock* is similar to the former, but its rind is of a dark red or purple colour; its size in general smaller, and its texture closer and firmer than that of the common white stock; it also stands the winter better, and is more succulent in the spring, but it is not so well relished by cattle as the former; whence it is less generally cultivated. 3. The *pudding-stock*, the *tankard-turnip* of the midland counties, is in shape so perfectly different from the common sort, that it might be ranked as a distinct species. It rises in a cylindrical form, eight, ten, or twelve

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Instrument for transplanting turnips. Bath Pers, vol. iv. p. 126.



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twelve inches high, standing in a manner wholly above ground; generally taking a rough irregular outline, and a somewhat reclining posture. It very much resembles the common turnip, and is by much its most formidable rival. In many respects it seems to be superior, particularly in being readily drawn, and eaten off by sheep with much less waste than the common turnip.—The disadvantage is, that they are liable to the attacks of frost, by reason of their standing so high above the surface of the ground; so that on the whole, Mr Marshall concludes, that the common white turnip is to be preferred to every other.

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Advantage
of using
marl.

In Norfolk, turnips are sown upon every species of arable land. Marl is found to be highly beneficial; and by means of this manure, a soil naturally unfit for turnips may be rendered proper for it. They succeed barley better than any other crop; some few are sown on wheat or pea stubble after harvest; but this is not a general practice. The manures in greatest reputation for turnips are dung, with a greater or smaller admixture of mould; *malt-combs* are also in good repute, and oil-cake is used by a few individuals; "but it may be said that nine acres of ten of the turnips grown in east Norfolk are manured with muck."—The quantity of dung set on for a crop of turnips generally depends on the quantity on hand, and the quantity of turnip ground to be manured. From 10 to 15 cart loads of muck are considered as a good dressing; and about a ton of oil cake to three acres; 50 or 60 bushels of malt-combs, and 40 or 60 bushels of soot, to an acre.

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Manures
of different
kinds.

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Cultivation
of turnips
for early
consump-
tion.

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Method of
sowing, and
culture.

When the turnips are intended for early consumption, the sooner they can be got into the ground the better; but when they are intended to stand the winter, the beginning of July is thought soon enough. The most general rule is to begin sowing about a week before midsummer, and continue till about a fortnight after, viz. from the 17th or 18th of June to the 7th or 8th of July.—Broad-cast sowing is universal, in the quantity of two pints to an acre. The seed is covered by two lines of a pair of light harrows drawn backward, in order to prevent the tines, which usually point something forward, from tearing up the clods, and burying the seed too deep. The horses are universally *walked* one way, and *trotted* back again in the same place. This is an excellent custom; the quick zig-zag motion of the harrows at once assisting to level the surface, and to distribute the seeds more evenly.—They are universally hoed; and unless they be sown very late, are generally hoed twice. The distance of time between the sowing and the first hoeing depends upon the soil and season; the size of the plants being the only guide. When turnips are suffered to grow too large before they are hoed, the plants are difficult to be set out singly, and are liable to be drawn up by weeds, thereby acquiring a slender upright tendency; whereas their natural growth in their infant state, is procumbent, spreading their first leaves on the ground, and taking the form of a rose.—If the hoe be put in too soon, the plants which are set out are liable to be buried, and their tender roots disturbed in the act of setting out the neighbouring plants. The time for hoeing, as directed by the most judicious husbandmen, is when the plants, as they lie spread upon the ground, are about the size of the palm of the hand:

if, however, seed-weeds be numerous and luxuriant, they ought to be checked before the turnips arrive at that size, lest by being drawn up tall and slender they should acquire a weak and sickly habit. The proper distance depends upon the nature of the soil and the time of sowing; such as are sown early, in a rich productive soil, require to be set out wider than those sown late on a soil of a contrary nature. If the soil be at par, the distance ought to be regulated by the time of sowing: if this be at par, the nature or state of the soil should be the regulator. Mr Marshall complains of the conduct of the Norfolk farmers in general in this respect, who "hack out their turnips, 14, 15, or perhaps 18 inches asunder, without any regard to the state of the soil, or time of sowing. This practice was established while the Norfolk soil was full of marl, and new to turnips; and when, it is probable, 11 or 12 inches in diameter was no uncommon size, with tops proportionally large and spreading; and 14 or 15 inches might then be a proper distance. But now, when the efficacy of marl is lessened, and the soil no longer the favourite of turnips, which seldom reach more than seven or eight inches in diameter, it is ruinous and absurd to continue the practice."

Turnips are cultivated either for seed, for sale, or for consumption. When cultivated for seed, it is supposed in most parts of the kingdom that it ought always to be taken from transplanted roots; but in Norfolk they are frequently raised from such as are untransplanted. "It is a fact (says Mr Marshall) well understood by every husbandman here, that if the seed be gathered repeatedly from untransplanted roots, the plants from this seed will become coarse-necked and foul-rooted: and the flesh of the root itself will become rigid and unpalatable. On the contrary, if it be gathered year after year from transplanted roots, the necks will become too fine, and the fibres too few: the entire plant acquiring a weak delicate habit, and the produce, though sweet, will be small. For the neck, or onset of the leaves, being reduced to the size of the finger (for instance), the number and size of the leaves will be reduced in proportion; and in a similar proportion will the number and size of the fibrils be reduced. From a parity of reasoning, it may perhaps be inferred, that when the neck acquires a thickness equal to that of the wrist, the size of the root will be in proportion."

"With respect to the fibres or rootlings, this is a just inference: but with respect to the bulb, it is in a great measure erroneous. For a few generations the size of the bulb will keep pace with the increase of leaves and fibres; but after having once reached the limits which nature has set to its magnitude, it begins to revert to its original state of wildness, from which to its present state it has undoubtedly been raised by transplantation. The farmer has therefore two extremes to avoid. The one is discoverable by the thickness and coarseness of the neck, the scaly roughness of the bulb, the thickness of the rind in general, the foulness of its bottom, and the forkedness of its main or tap-root: the other by the slenderness of the neck, the fineness of the leaf, and the delicacy of the root. The former are unpalatable to cattle, and are therefore creative of waste: the latter are unproductive, are difficult to be drawn, and do not throw out such ample tops

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ion of turnip
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ture of tops in the spring, as do those which are, by constitution or habit, in a middle state between these two extremes. There is not, however, any general rule respecting how many years turnips ought to be transplanted successively, and how often they ought to be suffered to run up from the seed-bed: the soil and situation have, and other circumstances may have, influence on the habit and constitution of vegetables as of animals; and the farmer must attend alone to the state of the turnips themselves. Whenever he judges, that, by repeated transplantation, they have passed the acme of perfection, then it is his duty and interest to let them run up to seed without transplantation. In Norfolk it has been found, by long experience, that transplanting two, three, or four years, and letting the plants run up the third, fourth, or fifth, will keep the stock in the desired state. The time of transplanting is from old Christmas to old Candlemas. In the choice of plants, the farmer is not guided by size, but picks the cleanest plants without regard to size; or more accurately speaking, he makes choice of such as are near, but not at or above the state of perfection. In almost every turnip-field there are plants in various states: much judgment, therefore, is requisite in the choice of plants. A piece of good ground near a habitation is generally chosen for this purpose; but the method of planting is various: the plants are generally set in rows, at uncertain distances from one another." These distances our author has observed to be 16 or 18 inches, and the distance of the plants in them nine or ten inches; but the practice of a man who, he tells us, is indisputably near the head of his profession, is to plant them in rows two feet asunder, the plants in the rows being contiguous. The only culture required, is to keep the intervals clean hoed; but when the seed begins to ripen, much care is requisite to keep it from birds. If the plot be large, it is necessary to employ a boy to scare them; but if it be small, and near the house, Mr Marshall has known the following expedient used with success. "On a slender post, rising in the midst of the patch of seed, was fixed a bell; from which a line passed into the kitchen: in the most frequented part of this hung the pull. Whoever passed the pull rung the bell; so that in a farm-house kitchen, where a mistress and two or three maids were some of them almost always on the foot, an incessant peal was kept up; and the birds, having no respite from alarm, forsook their prey."

The time of drawing commences about Michaelmas, and continues until the plants be in blow. The process of drawing, he says, "in severe weather, is an employment which nothing but custom could reconcile to those whose lot it is to go through it, namely, stout lads, and youths; whose hands are frequently swelled until the joints are discernible only by the dimples they form;" nevertheless he never heard of any instance of bad effects from this circumstance. When the tops will bear it, their method of pulling is very expeditious: they pull with both hands at once: and having filled each hand, they bring the two together with a smart blow to disengage the soil from the roots, and with the same motion throw them into the cart. If the tops be cut off by the frost, or if this be in the ground, the turnips are raised with two-tined forks named *crooms*. If the

roots are buried under deep snow, it is removed by means of an implement called the *snow-sledge*. This consists of three deal-boards from one to two inches thick, 10 or 12 inches deep, and from seven to nine feet long, set upon their edges in the form of an equilateral triangle, and strongly united with nails or straps of iron at the angles; at one of which is fastened, by means of a double strap, a hook or an eye, to fasten the horses to. This being drawn over a piece of turnips covered with snow, forces up the latter into a ridge on each side, while between the ridges a stripe of turnips is left bare, without having received any material injury from the operation. Though it is customary, in drawing, to clear the ground entirely, our author met with one instance in which the small ones were left by a very good husbandman on the ground, both to increase in size, and to throw out tops in the spring; it being observable, that a small turnip sends up a top nearly equal to one whose bulb is larger. There is one inconvenience, however, arising from this practice; the plough is prevented from entering upon the soil until late in the spring; which upon some soils is an unsurmountable objection; though it may be very proper upon land which will bring good barley with one ploughing after turnips.

Mr Marshall relates the following simple method, by which a Norfolk farmer preserved turnips through a considerable part of the winter season. Having cut off their tops with a spade, he gave them to his cows, and carried the bulbs to a new-made ditch, into which he threw them, and then covered them up with straw, laying over it a quantity of bramble kids. Here they lay until wanted in a frost. They were then again carted by means of a fork, and given to the cattle, who ate them as well, or rather better than fresh drawn turnips; and in general they came out as fresh as they went in. Our author is of opinion, that this method might be extended to the preservation of turnips till the spring.

3. CARROT.

Of all roots, a carrot requires the deepest soil. It ought at least to be a foot deep, all equally good from top to bottom. If such a soil be not in the farm, it may be made artificially by trench-ploughing, which brings to the surface what never had any communication with the sun or air. When this new soil is sufficiently improved by a crop or two with dung, it is fit for bearing carrots. Beware of dunging the year when the carrots are sown; for with fresh dung they seldom escape rotten scabs.

The only soils proper for that root are a loam and a sandy soil.

The ground must be prepared by the deepest furrow that can be taken, the sooner after harvest the better; immediately upon the back of which, a ribbling ought to succeed, as directed for barley. At the end of March, or beginning of April, which is the time of sowing the seed, the ground must be smoothed with a rake. Sow the seed in drills, with intervals of a foot for hand-hoeing; which is no expensive operation where the crop is confined to an acre or two: but if the quantity of ground be greater, the intervals ought to be three feet, in order for horse-hoeing.

In flat ground without ridges, it may be proper to make

Culture of particular Plants.

305 Snow-sledge described.

306 Method of preserving turnips.

307 Culture of carrot.

302 Method of planting.

303 Method of using birds.

304 Drawing turnips.

Culture of particular Plants. make parallel furrows with the plough, ten feet from each other, in order to carry off any redundant moisture.

Carrots have been greatly recommended as food for cattle, and, in this respect, bid fair to rival the potato; though, with regard to the human species, they are far inferior. The profit attending the cultivation of them, however, appears to be much more doubtful than that of potatoes. Mr Arthur Young informs us, that from Norden's Surveyor's Dialogue, published in 1600, it appears, "that carrots were commonly cultivated at that time about Orford in Suffolk, and Norwich in Norfolk; and he remarks, that the track of land between Orford, Woodbridge, and Saxmundum, has probably more carrots in it than all the rest of the kingdom put together." In 1779, few farmers in these parts had less than five or six acres; many from 10 to 20; and one had 36 acres: the straight, handsome, and clean roots were sent at 6d. per bushel to London; the rest being used at home, principally as food for horses. In other counties, he observes, the culture of carrots has not extended itself; that some have begun to cultivate them in place of turnips, but have soon desisted; so that the culture seems in a manner still confined to the angle of Suffolk, where it first began. In attempting to investigate the cause of this general neglect, he observes, that "the charge of cultivation is not so great as is commonly imagined, when managed with an eye to an extensive culture, and not a confined one for one or two particular objects." Two acres which our author had in carrots cost 3l. 17s. 6d. per acre, including every expence; but had not the summer been dry, he observes, that his expences might have been higher; and when he tried the experiment 15 years before, his expences, through inadvertence, ran much higher. His difficulty this year arose chiefly from the *polygonum aviculare*, the predominant weed, which is so tough that scarcely any hoe can cut it. Some acres of turnips which he cultivated along with the carrots were all eaten by the fly; but had they succeeded, the expence of the crop would have been 18s. 5d. less per acre than the carrots. "But (adds our author) if we call the superiority of expence 20s. an acre, I believe we shall be very near the truth: and it must at once be apparent that the expence of 20s. per acre cannot be the cause of the culture spreading so little; for, to answer this expence, there are favourable circumstances, which must not be forgotten. 1. They (the carrots) are much more impenetrable to frost, which frequently destroys turnips. 2. They are not subject to the distempers and accidents which frequently affect turnips; and they are sown at a season when they cannot be affected by drought, which frequently also destroys turnips. 3. They last to April, when stock, and especially sheep farmers are so distressed, that they know not what resource to provide. 4. The culture requisite for turnips on a sandy soil, in order to destroy the weeds, destroys also its tenacity, so that the crop cannot thrive; but with carrots the case is otherwise. Hence it appears, that the reason why the cultivation of carrots is still so limited, does not arise from the expence, but because the value is not ascertained. In places where these roots can be sent to London, or sold at a good price, the tops being used as food for cattle, there is not the least doubt that they are profitable; and therefore in such

places they are generally cultivated: but from the experiments as yet laid before the public, a satisfactory decisive knowledge of the value is not to be gained. The most considerable practice, and the only one of common farmers upon a large scale, is that of the sands of Woodbridge; but here they have the benefit of a London market, as already mentioned. Amongst those whose experiments are published, Mr Billingsley ranks foremost. Here again the value of carrots is rather depreciated than advanced; for he raised great crops, and had repeated experience upon a large scale of their excellence in fattening oxen and sheep; feeding cows, horses, and hogs; and keeping ewes and lambs in a very superior manner, late in the spring, after turnips were gone: but notwithstanding these great advantages, he gave the culture up; from which we may conclude a deficiency in value. "In several experiments (though not altogether determinate), I found the value upon an average of all applications, to be 13d. a bushel, heaped measure; estimating which at 70lb. weight, the ton is 1l. 14s." The following are the valuations of several gentlemen of the value of carrot in the way of fattening cattle:

	Per Ton.
Mr Mellish of Blyth, a general valuation of horses, cows, and hogs, -	L. 1 0 0
Mr Stovin of Doncaster, hogs bought lean, fatted, and sold off, -	4 0 0
Mr Moody of Ratford, oxen fatted, and the account accurate, -	1 0 0
Mr Taylor of Bifrons, saving of hay and corn in feeding horses, -	1 0 0
Mr Le Grand of Ash, fattening wethers, -	0 13 9
Sir John Hobby Mill of Bishan, fattening hogs, -	1 6 0
Mr Billingsley, for fattening hogs, -	1 13 6

Some other gentlemen whom our author consulted, could not make their carrots worth any thing: so that, on the whole, it appears a matter of the utmost doubt, so contradictory are the accounts, whether the culture of carrots be really attended with any profit or not. Thus Sir John Mill, by fattening hogs, makes 1l. 6s. and Mr Stovin 4l.; but others could not fatten hogs upon them at all: and some of Mr Young's neighbours told him, that carrots were good for nothing except to scour hogs to death. The experiment of Mr Le Grand upon wethers appeared to be made with the greatest accuracy; yet two circumstances seem to militate against it. 1. The sheep were put lean to them; whereas it is a fact well known, that if they are not half fat when put to turnips, no profit will result; and it is possible that the case may be the same with carrots. 2. He gave them also as much fine hay as they would eat.

In this uncertain state of the matter, the only thing that can be done is to make a number of experiments with as much accuracy as possible, in order to ascertain the real value per ton: and our author endeavours to show, that there is no danger of losing much by experiments of this kind. "I have shown (says he), that they are to be cultivated for 4l. per acre, left on the ground for sheep. Suppose the crop only two bushels at 70lb. each per rood, 320 per acre, or ten tons; it will readily be agreed, that such a produce is very low to calculate upon, since 20 tons are common among carrot

Bath Papers, vol. ii. p. 1.

308 Much cultivated in Suffolk and part of Norfolk.

309 Why the culture has not extended itself.

310 Superiority of carrots to turnips.

311 Difficulty of ascertaining the value.

312 New experiments.

culture of particular Plants. carrot cultivators. It appears from Mr Le Grand's experiments, that a wether worth 2l. 5s. eats 16lb. of carrots, and four pounds of hay per day: dropping the hay, and calculating for sheep of less than half that size (which are much more common), it will be perhaps an ample allowance to assign them 12lb. of carrots a day. If they are, as they ought to be, half fat when put up, they will be completely fattened in 100 days. At this rate, 20 wethers will, in 100 days, eat 11 tons, or very little more than one moderate acre. Now, let it be remembered, that it is a good acre of turnips which will fatten eight such wethers, the common Norfolk calculation: from which it appears, that one acre of carrots is, for this purpose, of more value than two of turnips. Further, let us suppose horses fed with them instead of oats: to top, cart, and pack up, 10 tons of carrots, I know may be done for 20s.—An acre therefore (other expences included) costs 5l. Fifty pounds weight of carrots are an ample allowance for a horse a day: ten tons, at that rate, last three horses for five months. But this 5l. laid out in oats at 16s. per quarter, will purchase little more than six quarters; which will last three horses, at two hushels each per week, no more than two months; a most enormous inferiority to the carrots."

313 periment feeding subs with am. In the same volume, p. 187. Mr Young gives an account of another experiment made by himself on the feeding of lambs with carrots. The quantities they ate varied excessively at different times; thirty-six of them consumed from five to ten bushels per day; but on an average, he rates them at four bushels of 56 pound per day. In all, they consumed 407 bushels from November to April, when they were sold and killed fat. At putting upon the carrots, the lambs were valued only at 18l. but were sold in April at 25l. 4s.; so that the value of the carrots was exactly 7l. 4s. or about 4d. per bushel. This price he supposes to be sufficient to induce any one to attempt the culture of carrots, as thus he would have a clear profit of 40s. per acre; "which (says he) is greater than can attend the best wheat crops in this kingdom." The land on which the carrots grew was sown next year with barley, and produced the cleanest in the parish; which contradicts an assertion our author had heard, that carrots make land foul. The grass upon which the sheep were fed with the carrots, and which amounted to about an acre, was very little improved for the crop of hay in 1781, owing to the dryness of the season; but in 1782 was greatly superior to the rest of the field, and more improved in quantity: "for, instead of an indifferent vegetation, scattered thick with the centaurea scabiosa, filago, rhinanthus, crista galli, and linum catharticum, with other plants of little value, it encouraged a very beautiful sheet of the best plants that can appear in a meadow, viz. the lathyrus pratensis, achillea millefolium, trifolium repens, trifolium ochroleucum, trifolium alpestre, and the plantago lanceolata.

314 roots compared in cabbage. In the same volume of the Bath Papers, p. 227, Mr Billingsley gives an account of the comparative profit of carrots and cabbages. Of the former, however, he obtained only seven tons, 15 cwt. per acre: the cabbages produced 36 tons: nevertheless, according to him, the profit of the former was 5l. 8s.; of the latter, only 3l. 11s. In a paper on the culture of carrots by Mr Kirby of Ipswich, vol. iii. p. 84. he informs us, that he

never determined the weight of an acre, but reckons the produce from 200 to 500 bushels; which, at 56lb. to the bushel, is from five to ten tons and an half. In the same volume, p. 320, the Rev. Mr Onley seems to prefer the culture of carrots to potatoes. "How-ever valuable (says he), from ease of culture, and greatness of produce, to the poor, especially in all small spots, I doubt, unless near great towns, whether, on a farming plan, potatoes be so eligible as other herbage or roots, especially as carrots, which I cannot but surmise (for my trials are too trivial to venture bolder language), deserve every encouragement, even on soils hitherto thought too heavy for them.—I am from experience convinced, that an acre of carrots will double in the quantum, of equally hearty provender, the product of an acre of oats; and from the nature of their vegetation, the nice mode of cultivation, and even of taking them up (all of which, expensive as they are, bear a very inferior proportion to the value of a medium crop), must leave the land, especially if taken off it in an early period, so mellow for the plough, as to form a seed-bed for barley equal to any fallow-tith."

Mr Onley's desideratum was a substitute for oats to feed horses; of which great numbers are kept in his county (Essex). Potatoes, he observes, are excellent for small pork, when baked or boiled, mixed with a little barley meal; but for large hogs, they are most profitably given raw, if these have at the same time the slack of the barn door in threshing season, &c. In the 5th volume he resumes the subject, and acquaints us, that he applied a single acre in his bean field to the culture of carrots, which generally produced 400 bushels; and this he considers as a small produce. "I am, however, sensible (says he) that they will amply repay every expence of the finest culture; and should, from their extensive utility on sound, deep, and friable land, be everywhere attempted. Some of my neighbours, who have been induced to try them on rather a larger scale, with finer culture, and fresher soil, have raised from 600 to 900 bushels per acre, and applied them more profitably, as well as more generally, than any other winter herbage, to deer, sheep, bullocks, cows, and horses. At the low-est calculation, from our little trials, they are computed to exceed turnips in value one-third, as to quantity of food: but are far superior in what arises from convenience for the stable; where to us they seem to be a substitute for corn to all horses, at least such as are not used in any quick work; and partially so with corn for those that are."

316 Superior to turnips and oats. In making a comparison betwixt the profit on oats and carrots, Mr Onley found the latter exceed by no less than 2l. 15s. 8d. per acre. His method of cultivation is to sow them in March or April; to hoe them three times, harrowing after each hoeing. Sometimes he left them in the ground till after Christmas, taking them up as wanted; but afterwards he took them up in October, in dry days, putting them directly into small upright cocks of 10 bushels each, covered entirely, with the tops cut off.—Thus, they appear to dry better than in any other way, and bear the weather with very little loss. If, after being thus dried, they are carried into any barn or shed, it will be better, if they are in large quantities, not to pack them close, on account of the danger of heating, but rather to throw them

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promiscuously into heaps, with a little straw over them. When perfectly dry, they do not in general require any washing, except for horses regularly kept in the stable.

This root has been found so generally valuable as a substitute for grain in feeding horses, that its use in that way is rapidly spreading into various parts of the country. By the quantity of saccharine matter which it contains, it is probably rendered extremely rich and stimulating to the stomach of that delicate animal, so that a less quantity of it goes to waste than of any other food. We may remark, that the gentleman already mentioned, Mr Onley, who had the merit of pressing upon the public attention the importance and utility of this root, mentions an use to which we believe it is not unfrequently applied in the dairy. "In our dairies (says he) as many carrots are bruised before churning, as produce, squeezed through a cloth into as much cream as makes eight or ten pounds of butter, a half pint of juice; this adds somewhat to the colour, richness, and flavour of winter butter; and we think, where hay is allowed besides, contributes much to counteracting the flavour from the feed of turnips. At present (our carrot feed being exhausted) from turnips and hay, with this juice, our butter is equal to that of the Epping dairies."

Annals of Agriculture, vol. xii.

317 Carrots used to colour butter.

318 Carrots advantageously cultivated in young plantations

We may conclude by taking notice here of an advantageous mode of cultivating carrots, by making use of them with a view to stir the ground in young plantations. It was adopted by Thomas Walford, Esq. of Birdbrook, Essex, who gives the following account of it:—"It has been my constant practice for these last five years, wherever I made a plantation of firs, or deciduous trees, to sow the ground in the spring with carrots, which I have found not only pay part of my expences, and frequently the whole, but much more beneficial to the trees than any other method I had before adopted.

"When I make a plantation of deciduous trees, the ground is dug two spits deep in October, and planted immediately, leaving it in that state until the middle or latter end of March, or beginning of April; then, if necessary, chop it over with a hoe, and sow my carrots: if for firs, I do not dig the ground until March, at which time I plant my trees, and sow the carrots, having found my crop more luxuriant and productive upon ground fresh dug than that which was dug in the autumn.—I give for digging 8d. per rod; hoe only twice; the produce is generally four bushels of clean carrots, which I sell at 6d. per bushel, the buyer to fetch them from their place of growth.

"The soil in some places loose and hollow; the under stratum clay: in others a fine vegetable mould upon a red loam.

"I find, in taking up the carrots, less damage is done to the young fibres of the trees, than by digging between them; for it is impossible, with the greatest care of your servants, not to cut off some of them by digging, and thereby injure the trees, besides leaving the ground in no better state than it is after carrots; for when the carrot is drawn, the cavity is filled immediately with loose mould, through which the young fibres will strike with great freedom, and very much accelerate the growth of the trees.

4. PARSNIPS.

Parsnips have never in this country received from husbandmen that attention to which they are well entitled, from the ease with which they are cultivated, and the great quantity of saccharine or nourishing matter of which they are known to contain, which certainly abounds in them, in a much greater proportion than in almost any other vegetable with which we are at present acquainted.

To cultivate this root (says Mr Hazard) so as to make it advantageous to the farmer, it will be right to sow the seed in the autumn immediately after it is ripe; by which means the plants will appear early the following spring, and get strong before the weeds can rise to injure them. Neither the seeds nor young plants are ever materially injured by frosts; on which account, as well as many others, the autumn is preferable to the spring sowing. The best soil for them is a rich deep loam, and next to this sand. They will thrive well in a black gritty soil, but not in stone-brash, gravel, or clay; and they are always largest in the deepest earth. If the soil be proper, they do not require much manure. Mr Hazard obtained a very good crop for three years upon the same piece of ground without using any; but when he laid on about 40 cart loads of sand per acre upon a stiff loam, and ploughed it in, he found it answer very well; whence he concludes, that a mixture of soils may be proper for this root. The seed may be sown in drills at about 18 inches distance from one another, that the plants may be the more conveniently hand or horse-hoed; and they will be more luxuriant, if they undergo a second hoeing, and are carefully earthed, so as not to cover the leaves. Such as have not ground to spare, or cannot get it in proper condition in autumn, may at that time sow a plot in their garden, and transplant from thence in the latter end of April, or early in the month of May following. The plants must be carefully drawn, and the ground well pulverized by harrowing and rolling; after which a furrow should be opened with the plough, about six or eight inches deep, in which the plants should be regularly laid at the distance of about ten inches from each other, taking care not to let the root be bent, but for the plant to stand perpendicular after the earth is closed about it, which ought to be done immediately by means of persons who should for this purpose follow the planter with a hoe. Another furrow must be opened about 18 inches from the former, in the same direction, and planted as before; and so on in like manner until all the plants are deposited, or the field be completely cropped; and when the weeds appear, hoeing will be necessary, and it will afterwards be proper to earth them; but if the leaves of the plants be covered with earth, the roots will be injured. Parsnips ought not to be planted by dibbling, as the ground thus becomes so bound, as seldom to admit the small lateral fibres with which these roots abound to fix in the earth, by which they are prevented from expanding themselves, and never attain a proper size. When circumstances are properly attended to, there is little doubt that a crop of parsnips would answer much better than a crop of carrots. They are equal, if not superior, in fattening pigs, as they make their

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319 The culti.

vation of parsnips too much neglected.

Bath Pa.

pers, vol. iv.

top. 244.

320 Mr Ha-

zard's method of cultivation.

ture of their flesh whiter, and the animals themselves are more fond of these roots than of carrots. Horses eat them greedily when clean washed and sliced among bran, and thrive very well upon them; and black cattle are said likewise to approve of them.

Though parsnips are little used in Britain, they are highly esteemed in France. In Brittany they are thought, as food for cattle, to be little inferior to wheat; and cows fed with them are said to give as much milk, and of as good quality, as in the summer months. In the island of Jersey they have long been considered as of the highest importance; and as the mode of cultivating them there seems worthy of attention, we shall here give an account of it, from a paper transmitted by the Agricultural Society of Jersey to the British Board of Agriculture.

321
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Guern-
"It is impossible, say these gentlemen, to trace the period when the cultivation of this plant was first introduced amongst us. It has been known for several centuries, and the inhabitants have reaped such benefit therefrom, that, for fattening their cattle and pigs, they prefer it to all the known roots of both hemispheres. The cattle fed therewith yield a juicy and exquisite meat. The pork and beef of Jersey are incontestably equal, if not superior, to the best in Europe. We have observed, that the beef in summer is not equal to that in the autumn, winter, and spring periods, when the cattle are fed with parsnips; which we attribute to the excellency of that root.

"All animals eat it with avidity, and in preference to potatoes. We are ignorant of the reason, having never made any analysis of the parsnip. It would be curious, interesting, and useful, to investigate its characteristic principles: it is certain that animals are more fond of it than of any other root, and fatten more quickly. The parsnip possesses, without doubt, more nutritious juices than the potato. It has been proved that the latter contains eleven ounces and a half of water, and one gros of earthy substance, French weight; therefore, there only remain four ounces and five gros of nutritive matter. Probably the parsnip does not contain near so much watery particles; nevertheless, they digest very easily in the animal's body. The cows fed with hay and parsnips during winter yield butter of a fine yellow hue, of a saffron tinge, as excellent as if they had been in the most luxuriant pasture."

These gentlemen proceed to state, that, in the island of Jersey, parsnips are not cultivated alone, but along with beans, among which last pease are sometimes mixed. There are three modes of cultivation: 1st, With the spade; 2d, With the plough and spade; and 3d, With two ploughs, the one called the small and the other the great plough. This last method, as being the most economical and advantageous to the husbandman, is the only one described. In the month of September, a slight ploughing and preparation is sometimes given to the field destined for beans and parsnips in the ensuing year; but more generally the whole work is performed in high grounds about the middle of February, and in the middle of March in low land. A light plough cuts and turns the earth about four or five inches deep; then follows it a large plough constructed on purpose, and only used for this operation, which elevates the earth on the furrow laid open, and turns it over that which the small plough turned up. The essential

point is to plough deep and to cover the clods over again.

The field thus prepared, is suffered to remain 15 days, after which it is very lightly harrowed. On the same day, or on the ensuing, the beans are planted in the following manner. Straight lines must be drawn from north to south with a gardeners rake at $4\frac{1}{2}$ feet distance. On these straight lines, 19 inches in breadth, women plant four or five beans in rows 4 inches distant from each other, or the beans are planted in double rows all over the field, at the usual depth, and 12 feet distance from each other, with the beans spaced out 18 inches from each other. When all this is done, the parsnips are sown in broad-cast over the field, after which it is well harrowed. In 15 days after, if the weather has been warm and rainy, or in three weeks if it has been cold and dry, the ground is harrowed again to cut up the weeds. In five or six weeks the beans shoot out, and the ground soon appears as if covered by hedges or laid out in paths for walking; for in the spaces between the lines where the beans were planted are as many alleys, where women and children weed with great facility. They generally weed the ground twice, and the operation is performed with a two-pronged fork, such as is used in gardens. The first weeding is performed at the end of April or beginning of May, when the plants must be cleared out if they are too thick. When the beans are ripe, which is in August or September, they are immediately plucked up, not to incommode the parsnips. The crop of beans is not always certain. If high winds or fogs prevail when they are in flower, the produce will be scanty; but the parsnips in a manner never fail. They neither dread the inclemency of the weather, nor are affected by the hardest frost, nor by any of those accidents which at times will instantly destroy a whole crop.

Parsnips grow till the end of September, but some give them to cattle they wish to fatten in the beginning of September. The people of these islands consider the parsnip as the most juicy and nutritious of all roots known. Its cultivation is an excellent preparation for wheat, which is sown there without manure after parsnips, and yields a plentiful crop. It must be observed, that though this cultivation of parsnips is expensive where the price of labour is high, no dung or manure is necessary either for the parsnips or the wheat. They reckon 20 perches of parsnips, with a little hay, will fatten an ox of three or four years old, though ever so lean; he eats them in the course of three months as follows: they are given at six in the morning, at noon, and at eight at night, in rations of 40lb. each; the largest are slit into three or four pieces; but not washed unless very much covered with earth. In the intermediate hours, at nine in the morning, two in the afternoon, and nine at night, a little hay is given. Experience has shewn, that when cattle, pigs, or poultry, are fed with parsnips, they are sooner fattened and are more bulky than with any other root or vegetable whatever. The meat of such is most delicate and savoury. In spring the markets are furnished with the best and fattest beef from their feeding on parsnips. The crops of parsnips raised in Jersey and Guernsey are very great. On an extent of 1000 feet, the produce of a field of beans and parsnips is about 1200lb. weight of parsnips, Rouen measure, and 30 cabots or half bushels

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bushels of beans, and three cabots and a half of pease ; which altogether, according to the price at which these articles are actually sold there, amount to the sum of 256 livres French currency. The following information was also received from the president of the Jersey Society on 1st March 1796, viz. " Since writing concerning the crop of beans and parsnips together, we have found that an individual who cultivates parsnips without sowing either pease or beans along with them had a crop of 14,760lb. weight Rouen measure per vergee." The vergee is 40 perches in length and one perch in breadth.

III. Plants cultivated for LEAVES, or for both LEAVES and ROOTS.

I. TURNIP-ROOTED CABBAGE.

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Cultivation of the turnip-rooted cabbage.

This plant may deservedly be reckoned next in value to the turnip itself. Its advantages, according to Sir Thomas Beavor, are, " that it affords food for cattle late in the spring, and resists mildew and frost, which sometimes destroy the common turnip ;" whence he is of opinion that every farmer who cultivates the common turnip should always have part of his farm laid out in the cultivation of this root. The importance and value of turnip-rooted cabbages seem only to have been lately ascertained. In the Bath Society papers we have the following account of Sir Thomas Beavor's method of cultivating them ; which from experience he found to be cheaper and better than any other.

" In the first or second week of June, I sow the same quantity of seed, hoe the plants at the same size, leave them at the same distance from each other, and treat them in all respects like the common turnip. In this method I have always obtained a plentiful crop of them ; to ascertain the value of which I need only inform you, that on the 23d day of April last, having then two acres left of my crop, sound, and in great perfection, I divided them by fold hurdles into three parts of nearly equal dimensions. In the first part I put 24 small bullocks of about 30 stone weight each (14lb. to the stone), and 30 middle-sized fat wethers, which, at the end of the first week, after they had eaten down the greater part of the leaves, and some part of the roots, I shifted into the second division, and then put 70 lean sheep into what was left of the first ; these fed off the remainder of the turnips left by the fat stock ; and so they were shifted through the three divisions, the lean stock following the fat as they wanted food, until the whole was consumed.

" The 24 bullocks and 30 fat wethers continued in the turnips until the 21st of May, being exactly four weeks ; and the 70 lean sheep until the 29th, which is one day over four weeks : so that the two acres kept me 24 small bullocks and 110 sheep four weeks (not reckoning the overplus day of keeping the lean sheep) ; the value, at the rate of keeping at that season, cannot be estimated in any common year at less than 4d. a-week for each sheep, and 1s. 6d. per week for each bullock, which would amount together to the sum of 14l. 10s. 8d. for the two acres.

" You will hardly, I conceive, think I have set the price of keeping the stock at too high a rate ; it is beneath the price here in almost every spring, and in this

last it would have cost double, could it have been procured ; which was so far from being the case, that hundreds of sheep and lambs here were lost, and the rest greatly pinched, for want of food.

" You will observe, gentlemen, that in the valuation of the crop above mentioned I have claimed no allowance for the great benefit the farmer receives by being enabled to suffer his grass to get into a forward growth, nor for the superior quality of these turnips in fattening his stock ; both which circumstances must stamp a new and a great additional value upon them. But as their continuance on the land may seem to be injurious to the succeeding crop, and indeed will deprive the farmer totally of either oats or barley ; so to supply that loss I have always sown buck-wheat on the first earth upon the land from which the turnips were thus fed off ; allowing one bushel of seed per acre, for which I commonly receive from five to six quarters per acre in return. And that I may not throw that part of my land out of the same course of tillage with the rest, I sow my clover or other grass seeds with the buck-wheat, in the same manner as with the oat or barley crops, and have always found as good a *layer* (ley) of it afterwards.

" Thus you see, that in providing a most incomparable vegetable food for cattle, in that season of the year in which the farmer is generally most distressed, and his cattle almost starved, a considerable profit may likewise be obtained, much beyond what is usually derived from his former practice, by the great produce and price of a crop raised at so easy an expence as that of buck-wheat, which with us sells commonly at the same price as barley, oftentimes more, and but very rarely for less.

" The land on which I have usually sown turnip-rooted cabbages is a dry mixed soil, worth 15s. per acre."

To the preceding account the society have subjoined the following note : " Whether we regard the importance of the subject, or the clear and practical information which the foregoing letter conveys, it may be considered as truly interesting as any we have ever been favoured with : and therefore it is recommended in the strongest manner to farmers in general, that they adopt a mode of practice so decisively ascertained to be in a high degree judicious and profitable."

To raise the turnip-rooted cabbage for transplanting, the best method yet discovered is, to breast-plough and burn as much old pasture as may be judged necessary for the seed bed ; two perches well stocked with plants will be sufficient to plant an acre. The land should be dug as shallow as possible, turning the ashes in ; and the seed should be sown the beginning of April.

The land intended for the plantation to be cultivated and dunged as for the common turnip. About midsummer (or sooner if the weather will permit) will be a proper time for planting, which is best done in the following manner : the land to be thrown into *one-bout* ridges, upon the tops of which the plants are to be set, at about 18 inches distance from each other. As soon as the weeds rise, give a hand-hoeing ; afterwards run the ploughs in the intervals, and fetch a furrow from each ridge, which after lying a fortnight or three weeks, is again thrown back to the ridges ; if the weeds rise again, it is necessary to give them another hand-hoeing.

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Recommendation by the Bath Society.

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To raise the turnip-rooted cabbage for transplanting.

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Their utility and value.

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If the young plants in the seed-bed should be attacked by the fly, sow wood-ashes over them when the dew is on, which will effectually prevent the ravages they would otherwise make.

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Comparison of the
quantity of
food in this
and in the
common
turnip.

In another letter from Sir Thomas Beavor, Bath Papers, vol. viii. p. 489, he expresses his hope that the turnip-rooted cabbages he had would last until he should have plenty of grass for all his stock. To make a comparative estimation of the quantity of food yielded by the turnip-rooted cabbage and the common turnip, he selected some of each kind, and having girted them with as much accuracy as possible, he found, that a turnip-rooted cabbage of 18 inches in circumference weighed $5\frac{1}{4}$ lb. and a common turnip of the same size only $3\frac{1}{4}$ lb.; on trying others, the general result was found to be in that proportion. Had they been weighed with the tops, the superiority of the turnip-rooted cabbage would have been greater, the tops of them being remarkably bushy. They were weighed in the month of March; but had this been done at Christmas, our author is of opinion that the difference would not have been so great; though he reckons this very circumstance of their continuing so long to afford a nourishing food, an instance of their excellency above almost any other vegetable whatever.

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Other ex-
periments.

In the fourth volume of the same work, Sir Thomas gives an account of another experiment on five acres of turnip-rooted cabbage, four of which were eaten upon the field, the other was pulled up and carried to the stables and ox-houses. They were sown and cultivated as other turnips; the beasts were put to them on the 12th of April, and continued feeding upon them till the 11th of May. The cattle fed for this space of time were, 12 Scotch bullocks weighing 40 stone each; eight homebreds, two years old; fifteen cows full-sized; 40 sheep; 18 horses; besides 40 store-hogs and pigs, which lived upon the broken pieces and offal, without any other allowance, for the whole four weeks. The whole value of the plant, exclusive of the feeding of the pigs, amounted, according to our author's calculation, to 18l.; and he says that the farmers would willingly give this sum in the spring for feeding as many cattle: "because it enables them to save the young shooting grass (which is so frequently injured by the tread of the cattle in the frosty nights) until it gets to such a length and thickness as to be afterwards but little affected by the summer's drought. Besides this, the tops or leaves are in the spring much more abundant, and much better food than those of the common turnip, as already observed; and they continue in full perfection after all the common turnips are rotten or worthless.

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Disadvan-
tages at-
tending
the cultiva-
tion of this
plant.

The disadvantages attending the cultivation of turnip-rooted cabbages are, that they require a great deal of time and pains to take them up out of the ground, if they are to be carried off the field; and if fed where they grow, it requires almost an equal labour to take up the pieces left by the cattle. A great deal of earth is also taken up along with the root; and the substance of the latter is so firm and solid, that they must be cut in two in order to enable the cattle to eat them. To obviate some of these objections, it will be proper to sow the plants on rich and very light land; and as they are longer in coming to the hoe than the common tur-

nip, it will be proper to sow them about the beginning of June.

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In another experiment upon this plant by the same gentleman, the cabbages held out during the long and severe frost of 1788 without the least injury, though it destroyed three-fourths of all the common turnips in the neighbourhood. On the 21st of April 1789, the average produce of an acre was found to be somewhat more than $24\frac{1}{2}$ tons, though the tops had not sprouted above three inches. Considering the precariousness of turnips and other crops, Sir Thomas is decisively of opinion, that all farmers ought to have as many turnip-rooted cabbages as would afford and ensure them a full provision for the cattle for about three or four weeks during the latter part of the spring. This quantity he reckons sufficient, as the consumption, particularly when drawn and carried off the land, is attended with more trouble and expence than that of common turnips, especially if the soil be wet and heavy. In another letter, dated May 3. 1790, Sir Thomas Beavor once more sets forth the advantages of having a crop of these vegetables during the spring season. "In consequence (says he) of the very cold weather we have had here, the grass is but just springing; as the turnips are wholly eaten up, it occasions much distress among the farmers for want of some green vegetable food for their sheep and cattle; whereas, by the assistance of my turnip-rooted cabbages, I have abundance of the best and most nutritive food that can be found them." He then proceeds to recommend their culture "for the support of almost all live stock for the three last weeks of April, or first week of May, when the grass shoots late."

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Why every
farmer
ought to
cultivate
this plant.

In the 4th volume of the Transactions of the Society for encouraging Arts, Mr Robins, who received a premium for raising the greatest quantity of this plant, informs us, that the soil on which it grew was a *stone braish*, inclining to sand, not worth more than 10s. per acre; the preparation the same as for turnips. The manure was a compost of earth and dung, which he finds to answer better than dung. The seed was sown about the beginning of April on a clean spot of ground; and he commonly uses an old pasture where the sheep-fold has been in the winter, after taking away the dung, and digging it very shallow; "as the roots of the young plants (says he) might soon reach the dung or salts, which must consequently be left, in order to force them out of the fly's way." These insects, our author observes, are extremely fond of the turnip-rooted cabbage; much more so, he believes, than of common turnips. About the middle of June they should be planted out upon one-bout ridges raised by a double plough made for the purpose. Seven thousand plants are sufficient for one acre; but if only six are used, the roots will be the larger.

To determine how many sheep might be kept upon an acre of turnip-rooted cabbage, our author shut up 200 ewes with their lambs upon a piece of poor pasture land of no great extent; the whole not exceeding ten acres. One ton was found sufficient for keeping them in sufficient health for a day. On giving them a larger piece of ground to run over, though it had been eaten all winter and late in the spring, yet, with this trifling assistance, 13 tons of turnip-cabbage were made to serve

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Number of
sheep fed
by an acre
of turnip-
rooted cab-
bages.

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Experi-
ments at
Cullen-
house.

18 days; at the end of which the ewes and lambs were found very much improved, which could not have been expected from four acres of turnips in the month of April, the time that these were fed.

From some trials made on the turnip-rooted cabbage at Cullen House in the north of Scotland, it appears that the plant is adapted to the climate of every part of our island. The first trial was made in the year 1784. The seeds were sown about the middle of March in garden ground properly prepared. The cabbages were transplanted about the middle of March that year, into a dry light soil, well cleaned and dunged with rotten cow dung, in rows three feet distant from each other, and at the distance of 20 inches in the rows. They were kept very clean, and the earth was hoed up to the roots of the plants; by which means they were probably prevented from attaining the hardness they would otherwise have arrived at; though, after all, it was necessary to cut the roots in two before the sheep could eat them. When thus cut, the animals ate them greedily, and even preferred them to every other food. The roots continued good for at least a month after the common turnips were unfit for use: some of them weighed from eight to ten pounds, and a few of them more. Other trials have since been made; and it now appears that the plant will thrive very well with the ordinary culture of turnips in the open fields, and in the usual manner of sowing broad-cast. From a comparative trial made by the earl of Fife upon this root with some others, the quantities produced upon 100 square yards of ground were as follows:

	stone.	lb.
Common turnips	92	4
Turnip-rooted cabbage	88	0
Carrots	95	0
Root of scarcity	77	0

The turnip-rooted cabbage was planted in lines 20 inches asunder; the common turnips sown broad-cast, and hand-weeded, so that they came up very thick, being not more than three or four inches asunder when full grown. Two cows were fed for six weeks with the turnips, two with the turnip-rooted cabbage, and two with the root of scarcity for an equal time: the two fed with turnips gave most milk, and those with the root of scarcity the least. His lordship observes however, that carrots thrive better on his farm than any other crop: that his horses had been fed on them at the rate of two pecks a-day, with no corn, and little more than half the usual quantity of hay. "They were kept at work every day from seven to eight hours, and were never in better order."

2. SWEDISH TURNIP, or ROOTA BAGA.

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Of the
roota бага.

The roota бага, or Swedish turnip, is a plant from which great expectations have been formed. It is said to be hardier than the common turnip, and of greater sweetness and solidity. It also preserves its freshness and succulence till a very late period of its growth, even after it has produced seed; on account of which property it has been recommended to the notice of farmers as an excellent kind of succulent food for domestic animals in the spring of the year, when common turnips and most other winter crops have failed, and

before grass has got up to furnish an abundant bite for feeding beasts. This peculiarity, so valuable, yet so singular as to have led many at first to doubt the fact, seems to be sufficiently ascertained by experiment. Dr J. Anderson* in particular informs us, that it "begins to send out its flower-stems in the spring, nearly about the same time with the common turnip; but that the root, in consequence of that change of state, suffers very little alteration. I continued to use these turnips at my table every day till towards the middle of May; and had I never gone into the garden myself, I should not even then have suspected, from the taste or appearance of the bulb itself, that it had been shot at all. The stems, however, at the season I gave over using them, were from four to five feet high, and in full flower. I should have continued the experiment longer, had not the quantity I had left for that purpose been exhausted, and a few only left for seed."

"This experiment, however, fully proves, that this kind of turnip may be employed as a succulent food for cattle till the middle of May at least, in an ordinary year; and I have not the smallest doubt but it will continue perfectly good for that purpose till the end of May in any season; at which time grass and other spring crops can easily be had for bringing beasts forward in flesh. I can therefore, without hesitation, recommend this plant to the farmer as a most valuable spring feeding for cattle and sheep; and for this purpose, I think no wise farmer should be without a proportion of this kind of turnip to succeed the other sorts after they fail. The profitable method of consuming it, where it is to be kept very late, is, I am convinced, to cut off the tops with a scythe or sickle when from one foot to eighteen inches high, to induce it to send out fresh stems, that will continue soft and succulent to the end; whereas, without this process, the stems would become sticky and useless."

"I cannot, however, recommend this kind of turnip, from what I have yet seen, as a general crop; because I think it probable, that unless in particular circumstances, the common field turnips grow to a much larger size, and afford upon the whole a more weighty crop. These, therefore, should still continue to be cultivated for winter use, the other being reserved only for spring consumption."

"Experiments are still wanting to ascertain with certainty the peculiar soil and culture that best agree with this plant; but from the few observations I have hitherto had an opportunity of making upon it, it seems to me probable, that it thrives better, and grows to a larger size, on damp clayey soil, than on light sandy land. But I would not wish to be understood as here speaking positively; I merely throw it out as a hint for future observation: on spongy soil it prospers."

"Though the uses of this as a garden plant are of much smaller consequence than those above specified, it may not be improper to remark, that its leaves form a very sweet kind of greens at any time; and merely for the sake of the experiment, I caused some of these to be picked off the stems of the plants coming to seed, on the 4th of June, the king's birth-day, which on being readied, were found perfectly sweet, without the smallest tendency to bitterness, which most, if not all, other kinds of greens that have been hitherto cultivated are known to acquire after their stems are considerably

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* The Bo
vol. iii.
p. 291.

culture of particular Plants. siderably advanced; no family, therefore, can ever be at a loss for greens when they have any of this plant in seed.

"A root of this kind of turnip was taken up this day (June 15.); the seed-stalks were firm and woody, the pods full formed, and in some of them the seeds were nearly ripe. The root, however, was as soft and succulent as at any former period of its growth; nor was the skin, as I expected, hard or woody. It was made ready and brought to the table: some persons there thought the taste as good, if not better, than at any former period of its growth; but I myself, perhaps through prejudice, thought it had not quite so high a relish as in winter: At any rate, however, there can be no doubt, that if ever it could be necessary, it might, even now, be employed very properly as a feeding for cattle."

This vegetable, from its obvious utility, is gradually coming to be much used in various quarters of the island. In the Agricultural Survey of Nottinghamshire, the following description of the modes in which it has been successfully cultivated, is well worthy of attention. "The roota бага, or Swedish turnip, is now cultivated by a few farmers in the district. It appears to be superior to the common turnip in many respects, particularly in hardiness, as it stood the last severe winter without the least injury. It is eaten with greediness by all animals, from the horse to the swine. Sheep prefer it to all others; but the material advantage that has been made of it, is the substituting it for corn in the food of draught horses; in which it has been found to answer the wish of every person who has yet tried it. The turnips are put into a tub or barrel, and cut small with an instrument like a hoe, with the blade put perpendicularly into the shaft; a man will cut in one hour as much as six horses can eat in twenty-four. The tops and bottoms are previously cut off and given to the pigs. Horses that are hard worked, look full as well when fed with this turnip and very little hay, as they formerly did when very high fed with corn. The Swedish turnip should be sowed early, from the 17th of May to the 10th of June."—The following information on the culture of the roota бага, is given in the same Survey, upon the authority of J. Daiken, Esq. of Nottingham.

Mr Daiken, about the 10th of May 1794, sowed about four acres with the seed of roota бага, about 2lbs. per acre, on good sand land, worth 20s. an acre, manured as for turnips, and having been ploughed four or five times; the rest of the field, to the amount of nine acres in all, with common turnip and turnip-rooted cabbage, all broad-cast. They were not transplanted, but hoed out nine inches asunder, at three hoeings, at 7s. 6d. an acre; no other culture. In November began to use them for horses, giving, at first clover and rye-grass hay, oats and beans; but finding that the horses did well upon them, left off all corn, and continued them on hay and the roots only; fifteen were thus fed for about two months, were constantly hard worked, and preserved themselves in very good condition. Mr Daiken is well convinced, that in this application they were worth 30l. an acre, that he would in future, if he could not get them otherwise, rather give that sum per acre for one or two acres, than not have them for this use. They lost their leaves

entirely when the frost set in; but the roots were not the least affected, though the common turnips in the same field were totally destroyed. Passengers passing through the field, cut holes in them, which did not let the frost injure them; nor were those hurt which were damaged by cattle biting them. Some came to the weight of 16lbs. and Mr Daiken thinks the average of the crop 8lbs. and much to exceed in tonnage per acre common turnips.

Mr Daiken gave them also to hogs, cattle and sheep. They are excellent for hogs; and sheep being let into the field before the common turnips were destroyed, gave so decided a preference to the roota бага, that they would not settle on the common turnips while the others were to be had.

The method of giving them to horses is to cut off the tap-root, to wash them, and to cut them roughly with a perpendicular hoe, and then given directly, without keeping them to dry. The horses ate them with avidity, and seemed even to prefer them to corn. Their qualities appear to be singular, as they bind horses, instead of relaxing them as other roots do. One mare was kept entirely upon them and straw, worked every day, did well, and never looked better; this mare was more bound by them than the rest. They have a strong effect upon making the coats fine, and one or two affected by the grease, were cured by them, as they act as a strong diuretic. In this mode of application, one acre maintained fifteen about two months: and Mr Daiken is so well convinced of the utility of the plant, as well as many of his neighbours, that he intends, and they also, to increase the cultivation much.

Mr Daiken suspects there are two sorts of the roota бага, because some, upon cutting, are white within, but in general yellow; otherwise of the same external appearance. The yellow is the best.

3. TURNIP CABBAGE.

This plant is as yet but little known. The seed is said to have been brought from the Cape of Good Hope by Mr Hastings, where it is very common, as well as in Holland. It has also had an existence in Britain for many years, though not generally known. It has a much greater affinity to the cabbage than to the turnip; and is very hardy, bearing the winter as well, if not better, than common brocoli, and may therefore be considered as a valuable acquisition to the kitchen garden as well as for cattle. The best time for sowing it for the garden is the end of May or beginning of June, though none of the plants have ever been observed to run to seed though sown ever so early. Even though sown in August at the cauliflower season, the greater part stood throughout the following summer, and did not seed till the second spring. The plants require nearly the same management with brocoli as to distance, transplanting, &c. and are usually most esteemed when young, and about the size of a moderate garden turnip; those sown in June will continue all winter. The bulb must be stripped clean of its thick fibrous rind; after which it may be used as a common turnip. The crown or sprout is very good, but especially in the spring, when they begin to run to seed. Mr Broughton, from whose account in the Bath Papers, vol. v. this article is taken, thinks that the turnip-cabbage

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turnip-cabbage is more nutritious than the common turnip. The largest bulb he measured was 23 inches circumference; but the thickness of the rind is so great, that some farmers imagined that the bulb would be too hard for sheep. The objection, however, was obviated by Mr Broughton, who gave some of the oldest and toughest bulbs to his sheep, and found that they not only penetrated through the rind, but even devoured the greatest part of it.

4. CABBAGE.

The cabbage has been recommended by long experience as an excellent food for cattle. Its uses as part of human food are also well known. It is therefore an interesting article in husbandry. It is easily raised, is subject to few diseases, resists frosts more than turnip, is palatable to cattle, and sooner fills them than turnip, carrot, or potatoes.

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cabbage.

The season for setting cabbage depends on the use it is intended for. If intended for feeding in November, December, and January, plants procured from seed sown the end of July the preceding year must be set in March or April. If intended for feeding in March, April and May, the plants must be set the first week of the preceding July, from seed sown in the end of February or beginning of March the same year. The late setting of the plants retards their growth; by which means they have a vigorous growth the following spring. And this crop makes an important link in the chain that connects winter and summer green food. Where cabbage for spring food happens to be neglected, a few acres of rye, sown at Michaelmas, will supply the want. After the rye is consumed, there is time sufficient to prepare the ground for turnip.

And now to prepare a field for cabbage. Where the plants are to be set in March, the field must be made up after harvest in ridges three feet wide. In that form let it lie all winter, to be mellowed with air and frost. In March, take the first opportunity, between wet and dry, to lay dung in the furrows. Cover the dung with a plough, which will convert the furrow into a crown, and consequently the crown into a furrow. Set the plants upon the dung, distant from each other three feet. Plant them so as to make a straight line cross the ridges, as well as along the furrows, to which a gardeners line stretched perpendicularly cross the furrows will be requisite. This will set each plant at the distance precisely of three feet from the plants that surround it. The purpose of this accuracy is to give opportunity for ploughing not only along the ridges, but cross them. This mode is attended with three signal advantages: it saves hand-hoeing, it is a more complete dressing to the soil, and it lays earth neatly round every plant.

If the soil be deep, and composed of good earth, a trench-ploughing after the preceding crop will not be amiss; in which case, the time for dividing the field into three-foot ridges, as above, ought to be immediately before the dunging for the plants.

If weeds happen to rise so close to the plants as not to be reached by the plough, it will require very little labour to destroy them with a hand-hoe.

Unless the soil be much infested with annuals, twice ploughing after the plants are set will be a sufficient dressing. The first removes the earth from the plants;

the next, at the distance of a month or so, lays it back.

Culture of
particular
Plants.

Where the plants are to be set in July, the field must be ribbed as directed for barley. It ought to have a slight ploughing in June before the planting, in order to loosen the soil, but not so as to bury the surface-earth; after which the three-foot ridges must be formed, and the other particulars carried on as directed above with respect to plants that are to be set in March.

In a paper already quoted from those of the Bath Society, Scots cabbages are compared, as to their utility in feeding cattle, with turnips, turnip-rooted cabbage, and carrots. In this trial the cabbages stand next in value to the carrots; and they are recommended as not liable to be affected by frost, if they be of the true flat-topped firm kind. Fifty-four tons have been raised upon an acre of ground not worth more than 12 shillings. There is likewise an advantage attending the feeding of cattle with cabbages, viz. that their dung is more in proportion than when fed with turnips or with hay; the former going off more by urine, and the latter having too little moisture. They also impoverish the ground much less than grain. Mr Billingsley accounts 46 tons per acre a greater crop than he ever read of; but Mr Vagg, in the 4th volume of Bath papers, give an account of a crop for which he received a premium from the Society, which was much superior to that of Mr Billingsley. Its extent was 12 acres; the produce of the worst was 42, and of the best 68 tons. They were manured with a compost of lime, weeds, and earth, that lay under the hedges round the field, and a layer of dung, all mixed and turned together. About 25 cart loads of this were spread upon an acre with the usual ploughing given to a common summer fallow; but for this he says, "admitting such crop to exhaust the manure in some degree by its growth, an ample restoration will be made by its refuse ploughed in, and by the stirring and cleaning of the ground." The whole expence of an acre, exclusive of the rent, according to Mr Vagg's calculation, amounts to 1l. 14s. 1d. only four ounces of seed being requisite for an acre. He recommends sowing the seed about the middle of August, and transplanting the young cabbages where they may be sheltered from the frost; and to the neglect of this he ascribes the partial failure, or at least inferiority of one part of his ground in the crop just mentioned, the young plants not being removed till near midsummer, and then in so dry a time, that they were almost scorched up.

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Quantity
raised on a
acre, &c.

In the Farmer's Magazine, vol. ii. p. 217. we have several pertinent remarks upon the culture of this useful plant, particularly with regard to watering. "It is a rule (says this correspondent) never to water the plants, let the season be as dry as it may: insisting that is entirely useless. If the land is in fine tilth and well dunged, this may be right, as the expence must be considerable; but it is probable, in very dry seasons, when the new set plants have nothing but a burning sun on them, that watering would save vast numbers, and might very well answer the expence, if a pond is near, and the work done with a water-cart." He takes notice also of another use of cabbages, which has not met with the attention it merits, viz. the planting

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Of water-
ing cab-

Culture of
particular
Plants.

planting of lands where turnips have failed. A late sown crop of these seldom turns to any account; but cabbages planted on the ground without any ploughing would prove very beneficial for sheep late in the spring; in all probability (unless on light, sandy, or limestone soils) of greater value than the turnips, had they succeeded.

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Cabbages
cultivated
in the mid-
land dis-
trict.

Mr Marshall observes, that in the midland district, a valuable sort of large green cabbage "is propagated, if not raised, by Mr Bakewell, who is not more celebrated for his breed of rams than for his breed of cabbages. Great care is observed here in raising the seed, being careful to suffer no other variety of the brassica tribe to blow near seed cabbages; by which means they are kept true to their kind. To this end, it is said that some plant them in a piece of wheat; a good method, provided the seed in that situation can be preserved from birds."

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Distance at
which they
ought to be
placed.

The advantage of having large cabbages is that of being able to plant them wide enough from each other, to admit of their being cleaned with the plough, and yet to afford a full crop. The proper distance depends in some measure on the natural size of the species and the strength of the soil; the thinner they stand, the larger they will grow: but our author is of opinion that cabbages, as well as turnips, are frequently set out too thin. Four feet by two and a half, according to Mr Marshall, are a full distance for large cabbages on a rich soil.

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Method of
transplant-
ing and
earthing
them.
Annals of
Agriculture,
vol. xv.

We think it of importance to take notice of the following mode of transplanting cabbages, or earthing them, as being consistent with the best mode of practice, and coming from the most respectable practical authority, Mr George Cully of Fenton. "We plant the cabbages, says he, not only in right lines but equidistant every way, so that we can plough between the rows, both long-ways and cross over; which, by loosening the earth so effectually on all sides, very much promotes their growth. But the matter I wished to inform you of, is the taking them up by the roots in the autumn whenever they have completed their growth, and putting them into the nearest stubble field you have, where a plough is ready to draw a straight furrow in the most convenient place; and at 20 yards distance, more or less, the ploughman makes another furrow parallel to the first. The cabbages are now turned out of the carts as conveniently as may be for a sufficient number of women to lay them along these furrows as close one to another as possible. The ploughman begins again where he first started, and turns a large furrow upon the cabbages, which is trodden down and righted by one, two, or more, as occasion requires, with each a spade in his hand to assist where the plough has by chance or accident not thrown earth enough. Thus the work goes on till all is finished.

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How pro-
tected from
caterpillars.

"We think we derive two advantages by the above process. In the first place, the cabbages keep sufficiently well through the winter in their new situation, while they do not draw or exhaust the land so much where they were growing: and, secondly, that land is at liberty to be sown with wheat as soon as cleared of the cabbages; which grain, in general, answers well after that green crop."

Cabbages and greens in general are apt to be infested by caterpillars. They may usually however be pro-

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tected against those vermin by pulling off the large undermost leaves, which may be given to cows in the month of August, or when the common white butterflies begin to appear in numbers. These butterflies lay their eggs, which produce the cabbage caterpillar, on the under side of the largest leaves of the cabbage plants. There is also said to be another remedy. It consists of sowing beans among the cabbages, which will greatly prevent the breeding of these worms; for it is said that the butterflies have an antipathy to the flavour of beans.

Culture of
Grass.

5. The ROOT of SCARCITY.

The *racine de disette*, or root of scarcity (*Beta cicla*), delights in a rich loamy land well dunged. It is directed to be sown in rows, or broad-cast, and as soon as the plants are of the size of a goose quill, to be transplanted in rows of 18 inches distance, and 18 inches apart, one plant from the other: care must be taken in the sowing, to sow very thin, and to cover the seed, which lies in the ground about a month, an inch only. In transplanting, the root is not to be shortened, but the leaves cut at the top; the plant is then to be planted with a setting stick, so that the upper part of the root shall appear about half an inch out of the ground: this last precaution is very necessary to be attended to. These plants will strike root in twenty-four hours, and a man a little accustomed to planting will plant with ease 1800 or 2000 a-day. In the seed-bed, the plants, like all others, must be kept clear of weeds: when they are planted out, after once hoeing, they will take care of themselves, and suffocate every kind of weed near them.

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Culture of
the root of
scarcity.

The best time to sow the seed is from the beginning of March to the middle of April: it is, however, advised to continue sowing every month until the beginning of July, in order to have a succession of plants. Both leaves and roots have been extolled as excellent both for man and beast. This plant is said not to be liable, like the turnip, to be destroyed by insects; for no insect touches it, nor is it affected by excessive drought, or the changes of seasons. Horned cattle, horses, pigs, and poultry, are exceedingly fond of it when cut small. The leaves may be gathered every 12 or 15 days; they are from 30 to 40 inches long, by 22 to 25 inches broad. This plant is excellent for milch cows, when given to them in proper proportions, as it adds much to the quality as well as quantity of their milk; but care must be taken to proportion the leaves with other green food, otherwise it would abate the milk, and fatten them too much, it being of so exceeding a fattening quality. To put all these properties beyond doubt, however, further experiments are wanting.

SECT. IV. Culture of Grass.

THE latter end of August, or the beginning of September, is the best season for sowing grass seeds, as there is time for the roots of the young plants to fix themselves before the sharp frosts set in. It is scarce necessary to say, that moist weather is best for sowing; the earth being then warm, the seed will vegetate immediately; but if this season prove unfavourable, they will do very well the middle of March following.

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Of laying
down fields
to grass.

3 H

If

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Grass.

If you would have fine pasture, never sow on foul land. On the contrary, plough it well, and clear it from the roots of couch-grass, rest-harrow, fern, broom, and all other noxious weeds. If these are suffered to remain, they will soon get above and destroy your young grass. Rake these up in heaps, and burn them on the land, and spread the ashes as a manure. These ploughings and harrowings should be repeated in dry weather. And if the soil be clayey and wet, make some under-drains to carry off the water, which, if suffered to remain, will not only chill the grass, but make it sour. Before sowing, lay the land as level and fine as possible. If your grass seeds are clean (which should always be the case), three bushels will be sufficient per acre. When sown, harrow it in gently, and roll it in with a wooden roller. When it comes up, fill up all the bare spots by fresh seed, which, if rolled to fix it, will soon come up and overtake the rest.

In Norfolk they sow clover with their grasses, particularly with rye-grass; but neither of these kinds will last long in the land. Where you intend it for a continuance, it is better to mix only small white Dutch clover, or marl grass, with your other grass seed, and not more than eight pounds to an acre. These are abiding plants, spread close on the surface, and make the sweetest feed of any for cattle. In the following spring, root up thistles, hemlock, or any large plants that appear. The doing this while the ground is soft enough to permit your drawing them up by the roots, and before they seed, will save you infinite trouble afterwards.

Some sow barley with their grasses, which they suppose to be useful in shading them, without considering how much the corn draws away the nourishment from the land.

Others take their seeds from a foul hay rick; by which means, besides filling the land with rubbish and weeds, what they intend for dry soils may have come from moist, where it grew naturally, and *vice versa*. The consequence is, that the ground, instead of being covered with a good thick sward, is filled with plants unnatural to it. The kinds of grass most eligible for pasture lands are, the annual meadow, creeping, and fine bent, the fox's-tail, and the crested dog's-tail, the poas, the fescues, the vernal oat-grass, and the ray or rye-grass. We do not, however, approve of sowing all these kinds together; for not to mention their ripening at different times, by which means you can never cut them all in perfection and full vigour, no kind of cattle are fond of all alike.

Horses will scarcely eat hay which oxen and cows will thrive upon; sheep are particularly fond of some kinds, and refuse others. The darnel-grass, if not cut before several of the other kinds are ripe, becomes so hard and wiry in the stalks, that few cattle care to eat it.

As the subject of pastures is very important, we shall first take notice of the general mode of improving ordinary pastures, and of the particular grass plants that ought to be cultivated in them. After which we shall mention the celebrated modern improvements upon grass lands, by flooding them artificially with water.

Pasture land is of such advantage to husbandry, that many prefer it even to corn land, because of the small hazard and labour that attend it; and as it lays the foundation for most of the profit that is expected from

the arable land, because of the manure afforded by the cattle which are fed upon it. Pasture ground is of two sorts: the one is meadow land, which is often overflowed; and the other is upland, which lies high and dry. The first of these will produce a much greater quantity of hay than the latter, and will not require manuring or dressing so often: but then the hay produced on the upland is much preferable to the other; as is also the meat which is fed in the upland more valued than that which is fattened in rich meadows; though the latter will make the fatter and larger cattle, as is seen by those which are brought from the low rich lands in Lincolnshire. But where people are nice in their meat, they will give a much larger price for such as hath been fed on the downs or in short upland pasture, than for the other which is much larger. Besides this, dry pastures have an advantage over the meadows, that they may be fed all the winter, and are not so subject to poach in wet weather; nor will there be so many bad weeds produced; which are great advantages, and do in a great measure recompense for the smallness of the crop.

The first improvement of upland pasture is, by fencing it. But in the fencing of land, the inclosure must not be made too small, especially where the hedge rows are planted with trees; because, when the trees are advanced to a considerable height, they will spread over the land; and where they are close, will render the grass so sour, that instead of being of an advantage, it will greatly injure the pasture.

The next improvement of upland pasture is, to make the turf good, where, either from the badness of the soil, or for want of proper care, the grass hath been destroyed by rushes, bushes, or mole-hills. Where the surface of the land is clayey and cold, it may be improved by paring it off, and burning it; but if it is a hot sandy land, then chalk, lime, marl, or clay, are very proper manures to lay upon it; but these should be laid in pretty good quantities, otherwise they will be of little service to the land.

If the ground is overrun with bushes or rushes, it will be of great advantage to the land to grub them up towards the latter part of summer, and after they are dried to burn them, and spread the ashes over the ground just before the autumnal rains; at which time the surface of the land should be levelled, and sown with grass seed, which will come up in a short time, and make good grass the following spring. So also, when the land is full of mole-hills, these should be pared off, and either burnt for the ashes, or spread immediately on the ground when they are pared off, observing to sow the bare patches with grass seed just as the autumnal rains begin.

Where the land has been thus managed, it will be of great service to roll the turf in the months of February and March with a heavy wooden roller; always observing to do it in moist weather, that the roller may make an impression; this will render the surface level, and make it much easier to mow the grass than when the ground lies in hills; and will also cause the turf thicken, so as to have what people usually term a *good bottom*. The grass likewise will be the sweeter for this husbandry, and it will be a great help to destroy bad weeds.

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How to improve upland pastures.

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Different kinds of grass.

Another

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Another improvement of upland pastures is the feeding of them; for where this is not practised, the land must be manured, at least every third year; and where a farmer hath much arable land in his possession, he will not care to part with his manure to the pasture. Therefore every farmer should endeavour to proportion his pasture to his arable land, especially where manure is scarce, otherwise he will soon find his error; for the pasture is the foundation of all the profit which may arise from the arable land.

Whenever the upland pastures are mended by manure, there should be a regard had to the nature of the soil, and a proper sort of manure applied: as for instance, all hot sandy land should have a cold manure; neats dung and swines dung are very proper for such lands; but for cold lands, horse-dung, ashes, and other warm manures, are proper. And when these are applied, it should be done in autumn, before the rains have soaked the ground, and rendered it too soft to cart on; and it should be carefully spread, breaking all the clods as small as possible, and then harrowed with bushes, to let it down to the roots of the grass. When the manure is laid on at this season, the rains in winter will wash it down, so that the following spring the grass will receive the advantage of it.

There should also be great care taken to destroy the weeds in the pasture every spring and autumn: for, where this is not practised, the weeds will ripen their seeds, which will spread over the ground, and thereby fill it with such a crop of weeds as will soon overbear the grass, and destroy it; and it will be very difficult to root them out after they have gotten such possession, especially ragwort, and such other weeds as have down adhering to their seeds.

The grass which is sown in these upland pastures seldom degenerates, if the land is tolerably good; whereas the low meadows, on which water stagnates in winter, in a few years turn to a harsh rushy grass, though the upland will continue a fine sweet grass for many years without renewing.

There is no part of husbandry of which the farmers are in general more ignorant than that of the pasture: most of them suppose that when old pasture is ploughed up, it can never be brought to have a good sward again; so their common method of managing their land after ploughing, is to sow with their crop of barley some grass seeds as they call them; that is, either the red clover, which they intend to stand two years after the corn is taken off the ground, or rye-grass mixed with trefoil; but as all these are at most but biennial plants, whose roots decay soon after their seeds are perfected, so the ground having no crop upon it, is again ploughed for corn; and this is the constant round which the lands are employed in by the better sort of farmers.

But whatever may have been the practice of these people, it is certainly possible to lay down lands which have been in tillage with grass, in such a manner as that the sward shall be as good, if not better, than any natural grass, and of as long duration. But this is never to be expected in the common method of sowing a crop of corn with the grass seeds; for, whenever this has been practised, if the corn has succeeded well, the grass has been very poor and weak; so that if the land has not been very good, the grass has scarcely been worth saving; for the following year it has produced

but little hay, and the year after the crop is worth little, either to mow or feed. Nor can it be expected to be otherwise, for the ground cannot nourish two crops; and if there were no deficiency in the land, yet the corn being the first and most vigorous of growth, will keep the grass from making any considerable progress, so that the plants will be extremely weak, and but very thin, many of them which come up in the spring being destroyed by the corn; for wherever there are roots of corn, it cannot be expected there should be any grass. Therefore the grass must be thin, and if the land is not in good heart, to supply the grass with nourishment, that the roots may branch out after the corn is gone, there cannot be any considerable crop of clover; and as their roots are biennial, many of the strong plants will perish soon after they are cut; and the weak plants, which had made but little progress before, will be the principal part of the crop for the succeeding year; which is frequently not worth standing.

Therefore, when ground is laid down for grass, ³⁴⁶How to sow upland pastures. there should be no crop of any kind sown with the seed, or at least the crop should be sown very thin, and the land should be well ploughed and cleaned from weeds, otherwise the weeds will come up the first, and grow so strong as to overbear the grass, and if they are not pulled up will entirely spoil it. The best season to sow the grass seeds upon dry land, when no other crop is sown with them, is about the middle of September or sooner, if there is an appearance of rain: for the ground being then warm, if there happen some good showers of rain after the seed is sown, the grass will soon make its appearance, and get sufficient rooting in the ground before winter; so will not be in danger of having the roots turned out of the ground by frost, especially if the ground is well rolled before the frost comes on, which will press it down, and fix the earth close to the roots. Where this hath not been practised, the frost has often loosened the ground so much, as to let in the air to the roots of the grass, and done it great damage; and this has been brought as an objection to the autumnal sowing of grass; but it will be found to have no weight if the above direction is practised: nor is there any hazard of sowing the grass at this season, but that of dry weather after the seeds are sown; for if the grass comes up well, and the ground is well rolled in the end of October, or the beginning of November, and repeated again the beginning of March, the sward will be closely joined at bottom, and a good crop of hay may be expected the same summer. But where the ground cannot be prepared for sowing at that season, it may be performed the middle or latter end of March, according to the season's being early or late; for, in backward springs, and in cold land, we have often sowed the grass in the middle of April with success; but there is danger, in sowing late, of dry weather, and especially if the land is light and dry; for we have seen many times the whole surface of the ground removed by strong winds at that season; so that the seeds have been driven in heaps to one side of the field. Therefore, whenever the seeds are sown late in the spring, it will be proper to roll the ground well soon after the seeds are sown, to settle the surface, and prevent its being removed.

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The sorts of seeds which are the best for this purpose, are, the best sort of upland hay seeds, taken from the cleanest pastures, where there are no bad weeds; if this seed is sifted to clean it from rubbish, three bushels will be sufficient to sow an acre of land. The other sort is the *trifolium pratense album*, which is commonly known by the names *white Dutch clover*, or *white honeysuckle grass*. Eight pounds of this seed will be enough for one acre of land. The grass seed should be sown first, and then the Dutch clover seed may be afterwards sown; but they should not be mixed together, because the clover seeds being the heaviest will fall to the bottom, and consequently the ground will be unequally sown.

When the seeds are come up, if the land should produce many weeds, these should be drawn out before they grow so tall as to overbear the grass; for where this has been neglected, the weeds have taken such possession of the ground as to keep down the grass, and starve it; and when these weeds have been suffered to remain until they have shed their seeds, the land has been so plentifully stocked with them as entirely to destroy the grass; therefore it is one of the principal parts of husbandry never to suffer weeds to grow on the land.

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Advantages
of rolling
grass.

If the ground is rolled two or three times at proper distances after the grass is up, it will press down the grass, and cause it to make a thicker bottom; for, as the Dutch clover will put out roots from every joint of the branches which are near the ground, so, by pressing down of the stalks, the roots will mat so closely together, as to form a sward so thick as to cover the whole surface of the ground, and form a green carpet, and will better resist the drought. For if we do but examine the common pastures in summer, in most of which there are patches of this white honeysuckle grass growing naturally, we shall find these patches to be the only verdure remaining in the fields. And this, the farmers in general acknowledge, is the sweetest feed for all sorts of cattle; yet never had any notion of propagating it by seeds, nor has this been long practised in England.

As the white clover is an abiding plant, so it is certainly the very best sort to sow, where pastures are laid down to remain; for as the hay-seeds which are taken from the best pastures will be composed of various sorts of grass, some of which may be but annual, and others biennial; so, when those go off, there will be many and large patches of ground left bare and naked, if there is not a sufficient quantity of the white clover to spread over and cover the land. Therefore a good sward can never be expected where this is not sown; for in most of the natural pastures, we find this plant makes no small share of the sward; and it is equally good for wet and dry land, growing naturally upon gravel and clay in most parts of England: which is a plain indication how easily this plant may be cultivated to great advantage in most sorts of land throughout this kingdom.

Therefore the true cause why the land which has been in tillage is not brought to a good turf again, in the usual method of husbandry, is, from the farmers not distinguishing which grasses are annual from those which are perennial: for if annual or biennial grasses are sown, these will of course soon decay; so that,

unless where some of their seeds may have ripened and fallen, nothing can be expected on the land but what will naturally come up. Therefore this, with the covetous method of laying down the ground with a crop of corn, has occasioned the general failure of increasing the pasture in many parts of Britain, where it is now much more valuable than any arable land.

After the ground has been sown in the manner before directed, and brought to a good sward, the way to preserve it good is, by constantly rolling the ground with a heavy roller, every spring and autumn, as hath been before directed. This piece of husbandry is rarely practised by farmers; but those who do, find their account in it, for it is of great benefit to the grass. Another thing should also be carefully performed, which is, to cut up docks, dandelion, knapweed, and all such bad weeds, by their roots every spring and autumn; this will increase the quantity of good grass, and preserve the pastures in beauty. Dressing of these pastures every third year is also a good piece of husbandry; for otherwise it cannot be expected the ground should continue to produce good crops. Besides this, it will be necessary to change the seasons of mowing, and not to mow the same ground every year, but to mow one season and feed the next; for where the ground is every year mown, it must be constantly dressed, as are most of the grass grounds near London, otherwise the ground will be soon exhausted.

Culmiferous grasses might be divided into two general classes for the purposes of the farmer, that it might be of use for him to attend to; viz. 1st, Those which, like the common annual kinds of corn, run chiefly to seed-stalks; the leaves gradually decaying as they advance towards perfection, and becoming totally withered, or falling off entirely, when the seeds are ripe. Rye-grass belongs to this class in the strictest sense. To it likewise may be assigned the vernal grass, dogs-tail grass, and fine bent grass. 2dly, Those whose leaves continue to advance even after the seed-stalks are formed, and retain their verdure and succulence during the whole season, as is the case with the fescue and poa tribes of grasses, whose leaves are as green and succulent when the seeds are ripe and the flower-stalks fading, as at any other time.

"It is wonderful, Mr Stillingfleet † remarks, to see how long mankind have neglected to make a proper advantage of plants of such importance, and which, in almost every country, are the chief food of cattle. The farmer, for want of distinguishing and selecting grasses for seed, fills his pastures either with weeds or bad or improper grasses; when, by making a right choice, after some trials, he might be sure of the best grass, and in the greatest abundance that his land admits of. At present, if a farmer wants to lay down his land to grass, what does he do? he either takes his seeds indiscriminately from his own foul hay rack, or sends to his next neighbour for a supply. By this means, besides a certain mixture of all sorts of rubbish, which must necessarily happen, if he chances to have a large proportion of good seeds, it is not unlikely but that what he intends for dry land may come from moist, where it grew naturally, and the contrary. This is such a slovenly method of proceeding, as one would think could not possibly prevail universally: yet this

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† Tracts
relating to
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is the case as to all grasses except the darnel-grass, and what is known in some few counties by the name of the *Suffolk-grass*; and this latter instance is owing, I believe, more to the soil than any care of the husbandman. Now, would the farmer be at the pains of separating once in his life half a pint or a pint of the different kinds of grass seeds, and take care to sow them separately, in a very little time he would have wherewithal to stock his farm properly, according to the nature of each soil, and might at the same time spread these seeds separately over the nation, by supplying the seed shops. The number of grasses fit for the farmer is, I believe, small; perhaps half a dozen or half a score are all he need to cultivate; and how small the trouble would be of such a task, and how great the benefit, must be obvious to every one at first sight. Would not any one be looked on as wild who should sow wheat, barley, oats, rye, pease, beans, vetches, buck-wheat, turnips, and weeds of all sorts together? yet how is it much less absurd to do what is equivalent in relation to grasses? Does it not import the farmer to have good hay and grass in plenty? and will cattle thrive equally on all sorts of food? We know the contrary. Horses will scarcely eat hay that will do well enough for oxen and cows. Sheep are particularly fond of one sort of grass, and fatten upon it faster than any other, in Sweden, if we may give credit to Linnæus. And may they not do the same in Britain? How shall we know till we have tried?"

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Kinds of
grass com-
monly
own.

The grasses commonly sown for pasture, for hay, or to cut green for cattle, are red clover, white clover, yellow clover, rye grass, narrow-leaved plantane, commonly called *ribwort*, sainfoin, and lucerne.

Red clover is of all the most proper to be cut green for summer food. It is a biennial plant when sown to perfect its seed; but when cut green, it will last three years, and in a dry soil longer. At the same time the safest course is to let it stand but a single year: if the second year's crop happen to be scanty, it proves, like a bad crop of pease, a great encourager of weeds, by the shelter it affords them.

Here, as in all other crops, the goodness of seed is of importance. Choose plump seed of a purple colour, because it takes on that colour when ripe. It is red when hurt in the drying, and of a faint colour when unripe.

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Of red clo-
ver.
Red clover is luxuriant upon a rich soil, whether clay, loam or gravel: it will grow even upon a moor when properly cultivated. A wet soil is its only bane; for there it does not thrive.

Plate
III, fig. 7.

To have red clover in perfection, weeds must be extirpated, and stones taken off. The mould ought to be made as fine as harrowing can make it; and the surface be smoothed with a light roller, if not sufficiently smooth without it. This gives opportunity for distributing the seed evenly; which must be covered by a small harrow with teeth no larger than those of a garden rake, three inches long, and six inches asunder*. In harrowing, the man should walk behind with a rope in his hand fixed to the back part of the harrow, ready to disentangle it from stones, clods, turnip or cabbage roots, which would trail the seed, and displace it.

Nature has not determined any precise depth for the seed of red clover more than of other seed. It will

grow vigorously from two inches deep, and it will grow when barely covered. Half an inch may be reckoned the most advantageous position in clay soil, a whole inch in what is light or loose. It is a vulgar error, that small seed ought to be sparingly covered. Misled by that error, farmers commonly cover their clover seed with a bushy branch of thorn; which not only covers it unequally, but leaves part on the surface to wither in the air.

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The proper season for sowing red clover, is from the middle of April to the middle of May. It will spring from the first of March to the end of August; but such liberty ought not to be taken except from necessity.

There cannot be a greater blunder in husbandry than to be sparing of seed. Ideal writers talk of sowing an acre with four pounds. That quantity of seed, say they, will fill an acre with plants as thick as they ought to stand. This rule may be admitted where grain is the object; but it will not answer with respect to grass. Grass seeds cannot be sown too thick: the plants shelter one another; they retain all the dew; and they must push upward, having no room laterally. Observe the place where a sack of pease, or of other grain, has been set down for sowing: the seed dropt there accidentally grows more quickly than in the rest of the field sown thin out of hand. A young plant of clover, or of sainfoin, according to Tull, may be raised to a great size where it has room; but the field will not produce half the quantity. When red clover is sown for cutting green, some recommend not less than 24 pounds to an acre. A field of clover is seldom too thick: the smaller a stem be, the more acceptable it is to cattle. It is often too thin; and when so; the stems tend to wood.

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Of sowing
clover with
grain.
Grain may be sown more safely with red clover than with almost any other grass; but with no crop more properly than flax. The soil must be highly cultivated for flax as well as for red clover. The proper season of sowing is the same for both; the leaves of flax being very small, admit of free circulation of air; and flax being an early crop, is removed so early as to give the clover time for growing. In a rich soil it has grown so fast, as to afford a good cutting that very year. Next to flax, barley is the best companion to clover. The soil must be loose and free for barley; and so it ought to be for clover: the season of sowing is the same; and the clover is well established in the ground before it is overtopped by the barley. At the same time, barley commonly is sooner cut than either oats or wheat. In a word, barley is rather a nurse than a stepmother to clover during its infancy. When clover is sown in spring upon wheat, the soil which has lain five or six months without being stirred, is an improper bed for it; and the wheat, being in the vigour of growth, overtops it from the beginning. It cannot be sown along with oats, because of the hazard of frost; and when sown as usual among the oats three inches high, it is overtopped, and never enjoys free air till the oats be cut. Add, that where oats are sown upon the winter furrow, the soil is rendered as hard as when under wheat.—Red clover is sometimes sown by itself without other grain: but this method, beside losing a crop, is not salutary; because clover in its infant state requires shelter.

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As to the quantity of grain proper to be sown with clover, two Linlithgow firlots make the proper quantity for an acre that produces commonly six bolls of barley. People may flatter themselves with the remedy of cutting barley green for food, if it happen to oppress the clover. This is an excellent remedy in a field of an acre or two; but the cutting an extensive field for food must be slow; and while one part is cutting, the clover is smothered in other parts.

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White and
yellow clo-
ver, rib-
wort, and
rye-grass.

The culture of white clover, of yellow clover, of ribwort, of rye-grass, is the same in general with that of red clover. We proceed to their peculiarities. Yellow clover, ribwort, rye-grass, are all of them early plants, blooming in the end of April or beginning of May. The two latter are evergreens, and therefore excellent for winter pasture. Rye-grass is less hurt by frost than any of the clovers, and will thrive in a moister soil: nor in that soil is it much affected by drought. In a rich soil, it grows four feet high: even in the dry summer 1775, it rose to three feet eight inches; but it had gained that height before the drought came on. These grasses are generally sown with red clover for producing a plentiful crop. The proportion of seed is arbitrary; and there is little danger of too much. When rye-grass is sown for procuring seed, five firlots wheat measure may be sown on an acre; and for procuring seed of ribwort, 40 pounds may be sown. The roots of rye-grass spread horizontally; they bind the soil by their number; and though small, are yet so vigorous as to thrive in hard soil. Red clover has a large tap-root, which cannot penetrate any soil but what is open and free; and the largeness of the root makes the soil still more open and free. Rye-grass, once a great favourite, appears to be discarded in many parts of Britain. The common practice has been, to sow it with red clover, and to cut them promiscuously the beginning of June for green food, and a little later for hay. Oats or barley cut green before the seed forms, will afford two other cuttings; which is the case of rye-grass, of yellow clover, and of ribwort. By such management, all the profit will be drawn that these plants can afford.

When red clover is intended for seed, the ground ought to be cleared of weeds, were it for no other purpose than that the seed cannot otherwise be preserved pure; what weeds escape the plough ought to be taken out by the hand. In England, when a crop of seed is intended, the clover is always first cut or pastured. This appears to be done, as in fruit trees, to check the growth of the wood, in order to encourage the fruit. It is best to eat the clover with sheep till the middle of May, which allows the seed to ripen. The seed is ripe when, upon rubbing it between the hands, it parts readily from the husk. Then apply the scythe, spread the crop thin, and turn it carefully. When perfectly dry, take the first opportunity of a hot day for threshing it on boards covered with a coarse sheet. Another way, less subject to risk, is to stack the dry hay, and to thresh it in the end of April. After the first threshing, expose the husks to the sun, and thresh them over and over till no seed remain. Nothing is more efficacious than a hot sun to make the husk part with its seed; in which view it may be exposed to the sun by parcels, an hour or two before the flail is applied.

White clover, intended for seed, is managed in the same manner. No plant ought to be mixed with rye-grass that is intended for seed. In Scotland, much rye-grass seed is hurt by transgressing that rule. The seed is ripe when it parts easily with the husk. The yellowness of the stem is another indication of its ripeness; in which particular it resembles oats, barley, and other culmiferous plants. The best manner to manage a crop of rye-grass for seed, is to bind it loosely in small sheaves, widening them at the bottom to make them stand erect; as is done with oats in moist weather. In that state they may stand till sufficiently dry for threshing. By this method they dry more quickly, and are less hurt by rain, than by close binding and putting the sheaves in shocks like corn. The worst way of all is to spread the rye-grass on the moist ground, for it makes the seed malten. The sheaves, when sufficiently dry, are carried in close carts to where they are to be threshed on a board, as mentioned above, for clover. Put the straw in a rick when a hundred stone weight or so is threshed. Carry the threshing board to the place where another rick is intended; and so on till the whole seed be threshed, and the straw ricked. There is necessity for close carts to save the seed, which is apt to drop out in a hot sun; and, as observed above, a hot sun ought always to be chosen for threshing. Carry the seeds in sacks to the granary or barn, there to be separated from the husks by a fanner. Spread the seed thin upon a timber floor, and turn it once or twice a-day till perfectly dry. If suffered to take a heat, it is useless for seed.

The writers on agriculture reckon sainfoin preferable to clover in many respects: They say, that it produces a larger crop; that it does not hurt cattle when eaten green; that it makes better hay; that it continues four times longer in the ground; and that it will grow on land that will bear no other crop.

Sainfoin has a very long tap-root, which is able to pierce very hard earth. The roots grow very large; and the larger they are, they penetrate to the greater depth; and hence it may be concluded, that this grass, when it thrives well, receives a great part of its nourishment from below the staple of the soil: of course, a deep dry soil is best for the culture of sainfoin. When plants draw their nourishment from that part of the soil that is near the surface, it is not of much consequence whether their number be great or small. But the case is very different when the plants receive their food, not only near, but also deep below, the surface. Besides, plants that shoot their roots deep are often supplied with moisture, when those near the surface are parched with drought.

To render the plants of sainfoin vigorous, it is necessary that they be sown thin. The best method of doing this is by a drill; because, when sown in this manner, not only the weeds, but also the supernumerary plants, can easily be removed. It is several years before sainfoin comes to its full strength; and the number of plants sufficient to stock a field, while in this imperfect state, will make but a poor crop for the first year or two. It is therefore necessary that it be sown in such a manner as to make it easy to take up plants in such numbers, and in such order, as always to leave in the field the proper number in their proper places. This can only be done, with propriety, by sowing the plants

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sainfoin.

plants in rows by a drill. Supposing a field to be drilled in rows at ten inches distance, the partitions may be hand-hoed, and the rows dressed in such a manner as to leave a proper number of plants. In this situation the field may remain two years; then one-fourth of the rows may be taken out in pairs, in such a manner as to make the beds of fifty inches, with six rows in each, and intervals of thirty inches, which may be ploughed. Next year, another fourth of the rows may be taken out in the same manner, so as to leave double rows, with partitions of ten inches, and intervals of thirty: All of which may be hoed at once or alternately, as it may be found most convenient.

The great quantity of this grass which the writers on this subject assure us may be raised upon an acre, and the excellency and great value of the hay made of it, should induce farmers to make a complete trial of it, and even to use the spade in place of the hoe or hoe-plough, if necessary.

The plants taken up from a field of sainfoin may be set in another field; and if the transplanting of this grass succeeds as well as the transplanting of lucerne has done with M. Lunin de Chateaufvieux, the trouble and expence will be sufficiently recompensed by the largeness of the crops. In transplanting, it is necessary to cut off great part of the long tap-root: this will prevent it from striking very deep into the soil, and make it push out large roots in a sloping direction, from the cut end of the tap-root. Sainfoin managed in this manner, will thrive even on shallow land that has a wet bottom, provided it be not overstocked with plants.

Whoever inclines to try the culture of this grass in Scotland, should take great pains in preparing the land, and making it as free from weeds as possible.

In England, as the roots strike deep in that chalky soil, this plant is not liable to be so much injured by drought as other grasses are, whose fibres strike horizontally, and lie near the surface. The quantity of hay produced is greater, and better in quality than any other. But there is one advantage attending this grass, which renders it superior to any other; and that arises from feeding with it milch cows. The prodigious increase of milk which it makes is astonishing, being nearly double that produced by any other green food. The milk is also better, and yields more cream than any other; and the butter procured from it is much better coloured and flavoured.

The following remarks by an English farmer are made from much experience and observation.

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Remarks
on the cul-
ture of sain-
foin in
England.

Sainfoin is much cultivated in those parts where the soil is of a chalky kind. It will always succeed well where the roots run deep; the worst soil of all for it, is where there is a bed of cold wet clay, which the tender fibres cannot penetrate. This plant will make a greater increase of produce, than common grass or turf on poor land. Where it meets with chalk or stone, it will extend its roots through the cracks and chinks to a very great depth in search of nourishment. The dryness is of more consequence than the richness of land for sainfoin; although land that is both dry and rich will always produce the largest crops.

It is very commonly sown broad-cast; but it is found to answer best in drills, especially if the land be made

fine by repeated ploughing, rolling, and harrowing. Much depends on the depth at which this seed is sown. If it be buried more than an inch deep, it will seldom grow; and if left uncovered, it will push out its roots above ground, and these will be killed by the air. March and the beginning of April are the best seasons for sowing it, as the severity of winter and the drought of summer are equally unfavourable to the young plants. A bushel of seed sown broad-cast, or half that quantity in drills, if good, is sufficient for an acre. The drills should be 30 inches apart, to admit of horse-hoeing between them. Much, however, depends on the goodness of the seed, which may be best judged of by the following marks:

The husk being of a bright colour, the kernel plump, of a gray or bluish colour without, and if cut across, greenish and fresh withinside; if it be thin and furrowed, and of a yellowish cast, it will seldom grow. When the plants stand single, and have room to spread, they produce the greatest quantity of herbage, and the seed ripens best. But farmers in general, from a mistaken notion of all that appears to be waste ground being unprofitable, plant them so close, that they choke and impoverish each other, and often die in a few years. Single plants run deepest and draw most nourishment; they are also easiest kept free from weeds. A single plant will often produce half a pound of hay, when dry. On rich land this plant will yield two good crops in a year, with a moderate share of culture. A good crop must not be expected the first year; but, if the plants stand not too thick, they will increase in size the second year prodigiously.

No cattle should be turned on the field the first winter after the corn is off with which it was sown, as their feet would injure the young plants. Sheep should not come on the following summer, because they would bite off the crown of the plants, and prevent their shooting again. A small quantity of soapers ashes as a top-dressing will be of great service, if laid on the first winter.

If the sainfoin be cut just before it comes into bloom, it is admirable food for horned cattle; and if cut thus early, it will yield a second crop the same season. But if it proves a wet season, it is better to let it stand till its bloom be perfected; for great care must be taken, in making it into hay, that the flowers do not drop off, as cows are very fond of them; and it requires more time than any other hay in drying. Sainfoin is so excellent a fodder for horses, that they require no oats while they eat it, although they be worked hard all the time. Sheep will also be fattened with it faster than with any other food.

If the whole season for cutting proves very rainy, it is better to let the crop stand for seed, as that will amply repay the loss of the hay; because it will not only fetch a good price, but a peck of it will go as far as a peck and a half of oats for horses.

The best time of cutting the seeded sainfoin is, when the greatest part of the seed is well filled, the first blown ripe, and the last blown beginning to open. For want of this care some people have lost most of their seed by letting it stand till too ripe. Seeded sainfoin should always be cut in a morning or evening, when the dews render the stalks tender. If cut when the sun shines hot, much of the seed will fall out and be lost.

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If the soil be tolerably good, a field of sainfoin will last from 15 to 20 years in prime; but at the end of seven or eight years, it will be necessary to lay on a moderate coat of well rotted dung; or, if the soil be very light and sandy, of marl. By this means the future crops, and the duration of the plants in health and vigour, will be greatly increased and prolonged. Hence it will appear, that for poor land there is nothing equal to this grass in point of advantage to the farmer.

Clover will last only two years in perfection; and often, if the soil be cold and moist, near half the plants will rot, and bald patches be found in every part of the field the second year. Besides, from our frequent rains during the month of September, many crops left for feeding are lost. But from the quantity and excellent quality of this grass (sainfoin), and its ripening earlier, and continuing in vigour so much longer, much risk and certain expence are avoided, and a large annual profit accrues to the farmer.

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lucerne.

The writers on agriculture, ancient as well as modern, bestow the highest encomiums upon lucerne as affording excellent hay, and producing very large crops. Lucerne remains at least 10 or 12 years in the ground, and produces about eight tons of hay upon the Scots acre. There is but little of it cultivated in Scotland. However, it has been tried in several parts of that country; and it is found, that when the seed is good, it comes up very well, and stands the winter frost. But the chief thing which prevents this grass from being more used in Scotland, is the difficulty of keeping the soil open and free from weeds. In a few years the surface becomes so hard, and the turf so strong, that it destroys the lucerne before the plants have arrived at their greatest perfection: so that lucerne can scarce be cultivated with success there, unless some method be fallen upon of destroying the natural grass, and preventing the surface from becoming hard and impenetrable. This cannot be done effectually by any other means than horse-hoeing. This method was first proposed by Mr Tull, and afterwards practised successfully by M. de Chateauvieux near Geneva. It may be of use therefore to give a view of that gentleman's method of cultivating lucerne.

He does not mention any thing particular as to the manner of preparing the land; but only observes in general, that no pains should be spared in preparing it. He tried the sowing of lucerne both in rows upon the beds where it was intended to stand, likewise the sowing it in a nursery, and afterwards transplanting it into the beds prepared for it. He prefers transplanting; because, when transplanted, part of the tap root is cut off, and the plant shoots out a number of lateral branches from the cut part of the root, which makes it spread its roots nearer the surface, and consequently renders it more easily cultivated: besides, this circumstance adapts it to a shallow soil, in which, if left in its natural state, it would not grow.

The transplanting of lucerne is attended with many advantages. The land may be prepared in the summer for receiving the plants from the nursery in autumn: by which means the field must be in a much better situation than if the seed had been sown upon it in the spring. By transplanting, the rows can be made more

regular, and the intended distances more exactly observed; and consequently the hoeing can be performed more perfectly and with less expence. M. Chateauvieux likewise tried the lucerne in single beds three feet wide, with single rows; in beds three feet nine inches wide, with double rows; and in beds four feet three inches wide, with triple rows. The plants in the single rows were six inches asunder, and those in the double and triple rows were about eight or nine inches. In a course of three years he found, that a single row produced more than a triple row of the same length. The plants of lucerne, when cultivated by transplantation, should be at least six inches asunder, to allow them room for extending their crowns.

He further observes, that the beds or ridges ought to be raised in the middle; that a small trench, two or three inches deep, should be drawn in the middle; and that the plants ought to be set in this trench, covered with earth up to the neck. He says, that if the lucerne be sown in spring, and in a warm soil, it will be ready for transplanting in September; that, if the weather be too hot and dry, the transplanting should be delayed till October; and that if the weather be unfavourable during both these months, this operation must be delayed till spring. He further directs, that the plants should be carefully taken out of the nursery, so as not to damage the roots; that the roots be left only about six or seven inches long; that the green crops be cut off within about two inches of the crown; that they be put into water as soon as taken up, there to remain till they are planted; and that they should be planted with a planting stick, in the same manner as cabbages.

He does not give particular directions as to the times of horse-hoeing; but only says, in general, that the intervals should be stirred once in the month during the whole time that the lucerne is in a growing state. He likewise observes, that great care ought to be taken not to suffer any weeds to grow among the plants, at least for the first two or three years; and for this purpose, that the rows as well as the edges of the intervals where the plough cannot go, should be weeded by the hand.

Burnet is peculiarly adapted to poor land; besides, it proves an excellent winter pasture when hard-ly any thing else vegetates. Other advantages are, It makes good butter; it never blows or swells cattle; it is fine pasture for sheep; and will flourish well on poor, light, sandy, or stony soils, or even on dry chalk hills.

The cultivation of it is neither hazardous nor expensive. If the land is prepared as is generally done for turnips, there is no danger of its failing. After the first year, it will be attended with very little expence, as the flat circular spread of its leaves will keep down, or prevent the growth of weeds.

On the failure of turnips, either from the fly or the black worm, some of our farmers have sown the land with burnet, and in March following had a fine pasture for their sheep and lambs. It will perfect its seed twice in a summer; and this seed is said to be as good as oats for horses; but it is too valuable to be applied to that use.

It is sometimes sown late in the spring with oats and barley,

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^{Culture of Grass.} barley, and succeeds very well; but it is best to sow it singly in the beginning of July, when there is a prospect of rain, on a small piece of land, and in October following transplant it in rows two feet apart, and about a foot distant in the rows. This is a proper distance, and gives opportunity for hoeing the intervals in the succeeding spring and summer.

After it is fed down with cattle, it should be harrowed clean. Some horses will not eat freely at first, but in two or three days they are generally very fond of it. It affords rich pleasant milk, and in great plenty.

A gentleman farmer near Maidstone, some years since, sowed four acres as soon as the crop of oats was got off, which was the latter end of August. He threw in 12 pounds of seed per acre, broad-cast; and no rain falling until the middle of September, the plants did not appear before the latter end of that month. There was however a good crop; and in the spring he set the plants out with turnip hoe, leaving them about a foot distant from each other. But the drill method is preferable, as it saves more than half the seed. The land was a poor dry gravel, not worth three shillings an acre for any thing else.

The severest frost never injures this plant; and the oftener it is fed the thicker are its leaves, which spring constantly from its root.

We shall here enumerate a few more of the grasses which have been accounted valuable, or are likely to become so.

³⁵⁸ *Alopecurus bulbosus*, BULBOUS FOXTAIL-GRASS, is recommended by Dr Anderson*, as promising on some occasions to afford a valuable pasture-grass. It seems chiefly, he observes, to delight in a moist soil, and therefore promises to be only fit for a meadow pasture-grass. The quality that first recommended it to his notice, was the unusual firmness that its matted roots gave to the surface of the ground, naturally soft and moist, in which it grew; which seemed to promise that it might be of use upon such soils, chiefly in preventing them from being much poached by the feet of cattle which might pasture upon them. Mossy soils especially are so much hurt by poaching, that any thing that promises to be of use in preventing it deserves to be attended to.

³⁵⁹ *Poa pratensis*, GREAT MEADOW-GRASS, seems to approach in many respects to the nature of the purple fescue; only that its leaves are broader, and not near so long, being only about a foot or 16 inches at their greatest length. Like it, it produces few seed stalks and many leaves, and is an abiding plant. It affects chiefly the dry parts of meadows, though it is to be found on most good pastures. It is very retentive of its seeds, and may therefore be suffered to remain till the stalks are quite dry. It blossoms the beginning of June, and its seeds are ripe in July.

³⁶⁰ *Poa compressa*, CREEPING MEADOW-GRASS, according to Dr Anderson, seems to be the most valuable grass of any of this genus. Its leaves are firm and succulent, of a dark Saxon-green colour; and grow so close upon one another, as to form the richest pile of pasture grass. The flower-stalks, if suffered to grow, appear in sufficient quantities: but the growth of these does not prevent the growth of the leaves, both advancing together during the whole summer; and when the stalks fade, the leaves continue as green as before. Its

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leaves are much larger and more abundant than the common meadow-grass, *poa trivialis*; and therefore it better deserves to be cultivated.

³⁶¹ *Anthoxanthum odoratum*, VERNAL GRASS, grows very commonly on dry hills, and likewise on sound rich meadow-land. It is one of the earliest grasses we have; and from its being found on such kinds of pastures as sheep are fond of, and from whence excellent mutton comes, it is most likely to be a good grass for sheep pastures. It gives a grateful odour to hay. In one respect, it is very easy to gather, as it sheds its seeds upon the least rubbing. A correspondent of the Bath Society, however, mentions a difficulty that occurs in collecting them, owing to its being surrounded with taller grasses at the time of its ripening, and being almost hid among them. If it be not carefully watched when nearly ripe, he observes, and gathered within a few days after it comes to maturity, great part of the seed will be lost. The twisted elastic awns, which adhere to the seeds, lift them out of their receptacles with the least motion from the wind, even while the straw and ear remain quite erect. It is found mostly in the moist parts of meadows; very little of it on dry pastures. It flowers about the beginning of May, and is ripe about the middle of June.

³⁶² *Cynosurus cristatus*, CRESTED DOG'S-TAIL GRASS. Mr Stillingfleet imagines this grass to be proper for parks, from his having known one, where it abounds, that is famous for excellent venison. He recommends it also, from experience, as good for sheep; the best mutton he ever tasted, next to that which comes from hills where the purple and sheep's fescue, the fine bent, and the silver hair grasses abound, having been from sheep fed with it. He adds, that it makes a very fine turf upon dry sandy or chalky soils: but unless swept over with the scythe, its flowering-stems will look brown; which is the case of all grasses which are not fed on by variety of animals. For that some animals will eat the flowering stems is evident from commons, where scarcely any parts of grasses appear but the radical leaves. This grass is said to be the easiest of the whole group to collect a quantity of seeds from. It flowers in June, and is ripe in July.

³⁶³ *Stipa pennata*, COCK'S TAIL, or FEATHER GRASS. ³⁶⁴ *Agrostis capillaris*, FINE BENT, is recommended by Mr Stillingfleet, from his having always found it in great plenty on the best sheep pastures in the different counties of England that are remarkable for good mutton. This grass flowers and ripens its seed the latest of them all. It seems to be lost the former part of the year, but vegetates luxuriantly towards the autumn. It appears to be fond of moist grounds. It retains its seed till full ripe; flowers the latter end of July, and is ripe the latter end of August.

Aira flexuosa, MOUNTAIN HAIR.

— *caryophyllæ*, SILVER HAIR.

The same may be said of these two grasses as of the preceding one.

³⁶⁵ *Festuca fluitans*, FLOTE FESCUE. In a piece published in the *Amœnitates Academicæ*, vol. iii. entitled *Plantæ Esculentæ*, we are informed, that "the seeds of this grass are gathered yearly in Poland, and from thence carried into Germany, and sometimes into Sweden, and sold under the name of *manna seeds*."—These are much

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used at the tables of the great, on account of their nourishing quality and agreeable taste. It is wonderful (adds the author), that amongst us these seeds have hitherto been neglected, since they are so easily collected and cleansed." There is a clamminess on the ear of the fote fescue, when the seeds are ripe, that tastes like honey: and for this reason perhaps they are called *manna seeds*.

Linnæus (*Flor. Suec.* art. 95.) says that the bran of this grass will cure horses troubled with botts, if kept from drinking for some hours.

Concerning this grass we have the following information by Mr Stillingfleet. "Mr Dean, a very sensible farmer at Ruscomb, Berkshire, assured me that a field, always lying under water, of about four acres, that was occupied by his father when he was a boy, was covered with a kind of grass, that maintained five farm horses in good heart from April to the end of harvest, without giving them any other kind of food, and that it yielded more than they could eat. He, at my desire, brought me some of the grass, which proved to be the fote fescue with a mixture of the marsh-bent; whether this last contributes much towards furnishing so good pasture for horses, I cannot say. They both throw out roots at the joints of the stalks, and therefore are likely to grow to a great length. In the index of dubious plants at the end of Ray's Synopsis, there is mention made of a grass, under the name of *gramen caninum supinum longissimum*, growing not far from Salisbury, 24 feet long. This must by its length be a grass with a creeping stalk; and that there is a grass in Wiltshire growing in watery meadows, so valuable that an acre of it lets from 10 to 12 pounds, I have been informed by several persons. These circumstances incline me to think it must be the fote fescue; but whatever grass it be, it certainly must deserve to be inquired after.

368
Meadow
foxtail.

Alopecurus pratensis, MEADOW FOXTAIL. Linnæus says that this is a proper grass to sow on grounds that have been drained. Mr Stillingfleet was informed, that the best hay which comes to London is from the meadows where this grass abounds. It is scarce in many parts of England, particularly Herefordshire, Berkshire, and Norfolk. It may be gathered at almost any time of the year from hay-ricks, as it does not shed its seeds without rubbing, which is the case of but few grasses. It is among the most grateful of all grasses to cattle. It is ripe about the latter end of June.

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Annual
meadow
grass.

Poa annua, ANNUAL MEADOW GRASS. "This grass (says Mr Stillingfleet) makes the finest of turfs. It grows everywhere by way sides, and on rich sound commons. It is called in some parts the *Suffolk grass*. I have seen whole fields of it in High Suffolk without any mixture of other grasses; and as some of the best salt butter we have in London comes from that county, it is most likely to be the best grass for the dairy. I have seen a whole park in Suffolk covered with this grass: but whether it afford good venison, I cannot tell, having never tasted of any from it. I should rather think not, and that the best pasture for sheep is also the best for deer. However, this wants trial. I remarked on Malvern-hill something particular in relation to this grass. A walk that was made there for the

convenience of the water drinkers, in less than a year was covered in many places with it, though I could not find one single plant of it besides in any part of the hill. This was no doubt owing to the frequent treading, which above all things makes this grass flourish; and therefore it is evident that rolling must be very serviceable to it. It has been objected, that this grass is not free from *bents*, by which word is meant the flowering-stems. I answer, that this is most certainly true, and that there is no grass without them. But the flowers and stems do not grow so soon brown as those of other grasses; and being much shorter, they do not cover the radical leaves so much; and therefore this grass affords a more agreeable turf without mowing than any other whatever that I know of." The seeds of this species drop off before they are dry, and to appearance, before they are ripe. The utmost care is therefore necessary in gathering the blades, without which very few of the seeds will be saved. It ripens from the middle of April, to so late, it is believed, as the end of October; but mostly disappears in the middle of the summer. It grows in any soil and situation, but rather affects the shade.

A new grass from America (named *Agrostis cornucopie*), was some time ago much advertised and extolled, as possessing the most wonderful qualities, and the seeds of it were sold at the enormous rate of 68l. the bushel. But we have not heard that it has at all answered expectation. On the contrary, we are informed by Dr Anderson, in one of his publications*, that "it has upon trial been found to be good for nothing. Of the seeds sown, few of them ever germinated: but enough of plants made their appearance, to ascertain, that the grass, in respect of quality, is among the poorest of the tribe; and that it is an *annual* plant, and altogether unprofitable to the farmer."

Chicorum Intybus, Chicory.

Mr Arthur Young has anxiously endeavoured to diffuse a knowledge of this plant, and he appears to have been the first person that introduced it into the agriculture of England from France, where it grows naturally on the sides of the roads and paths, and is sometimes cultivated as a salad. When it has been sown by itself, in ground prepared by good tillage, it has yielded two crops the same year. When sown amongst oats, no crop is expected till the following year. This plant defies the greatest droughts, and resists every storm. Being of very early growth, its first leaves, which are large and tufted, spread sidewise and cover the ground so as to retain the moisture, and preserve its roots from the heat which so often dries up every other vegetable production: it has not any thing to fear from storms, for its thick and stiff stalks support themselves against the winds and heaviest rains. The most severe cold and frosts cannot injure it. The quickness of its growth, above all, renders it most valuable, because it furnishes an abundance of salutary fodder in a season, when the cattle, disgusted with their dry winter food, greedily devour fresh plants.

This plant is greedily eaten by all sorts of cattle, but it is difficult to make into hay. It is very voluminous, and dries ill, unless the weather be very favourable for it. The dry fodder, however, which it does yield, is eaten with pleasure by the cattle. The following

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Agrostis
cornucopia

* Bee, v.
i. p. 38.

371
Chicory.

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sown April 1788.

Green produce.

	Tons.	cwt.
Cut July 24, - - -	9	10
October 17, - - -	9	14

Produce of the year of sowing, 19 4

1789. Cut May 21, - - -	12	11
July 24, - - -	16	4
December 3, - - -	9	14

Produce of the second year, 38 9

1790. Cut June 8, - - -	18	15
August 15, - - -	19	9

Produce of the third year, 38 4

The following English grasses are recommended to attention by Mr Curtis, author of the *Flora Londonensis*; and he has given directions for making experiments with grass seeds in small quantities.

372 Tall oat-grass. "*Avena elatior*, tall oat-grass; common in wet meadows, and by the sides of hedges; early, and very productive, but coarse.

373 Yellow oat-grass. "*Avena flavescens*, yellow oat-grass; affects a dry soil, is early and productive, bids fair to make a good sheep pasture.

374 Rough oat-grass. "*Avena pubescens*, rough oat-grass; soil and situation nearly similar to that of the meadow fescue; hardy, early, and productive.

375 Upright broom-grass. "*Bromus erectus*, upright broom-grass; peculiar to chalky soils; early and productive; promises to be a good grass for chalky lands, and thrives indeed very well on others.

376 Blue dogs-tail. "*Cynosurus cæruleus*, blue dogs-tail grass; earliest of all the grasses; grows naturally on the tops of the highest limestone rocks in the northern part of Great Britain: not very productive, yet may perhaps answer in certain situations, especially as a grass for sheep; bears the drought of summer remarkably well: at all events seems more likely to answer than the sheep's fescue grass, on which such encomiums have, most unjustly, been lavished.

377 Rough cock's-foot grass. "*Dactylis glomeratus*, rough cock's-foot grass; a rough coarse grass, but extremely hardy and productive: soil and situation the same as the meadow fescue.

378 Tall fescue grass. "*Festuca elatior*, tall fescue grass; tall and coarse, but very productive; affects wet situations.

379 Hard fescue grass. "*Festuca duriuscula*, hard fescue grass; affects such situations as the smooth-stalked meadow grass; is early and tolerably productive: its foliage is fine, and of a beautiful green; hence we have sometimes thought it was of all others the fittest for a grass-plat or bowling-green; but we have found, that though it thrives very much when first sown or planted, it is apt to become thin, and die away after a while.

380 Meadow cat's-tail grass. "*Phleum pratense*, meadow cats-tail grass; affects wet situations; is very productive, but coarse and late."

To sow grass seeds in small quantities, this author gives the following directions:—

"If a piece of ground can be had, that is neither

very moist nor very dry, it will answer for several sorts of seed: they may then be sown on one spot; but if such a piece cannot be obtained, they must be sown on separate spots according to their respective qualities, no matter whether in a garden, a nursery, or in a field, provided it be well secured and clean. Dig up the ground, level and rake it, then sow each kind of seed thinly in a separate row, each row about a foot apart, and cover them over lightly with the earth; the latter end of August or beginning of September will be the most proper time for this business. If the weather be not uncommonly dry, the seeds will quickly vegetate, and the only attention they will require will be to be carefully weeded. In about a fortnight from their coming up, such of the plants as grow thickly together may be thinned, and those which are taken up transplanted, so as to make more rows of the same grass.

"If the winter should be very severe, though natives, as seedlings they may receive injury; therefore it will not be amiss to protect them with mats, fern, or by some other contrivance.

"Advantage should be taken of the first dry weather in the spring, to roll or tread them down, in order to fasten their roots in the earth, which the frost generally loosens: care must still be taken to keep them perfectly clear from weeds. As the spring advances, many of them will throw up their flowering stems, and some of them will continue to do so all the summer. As the seed in each spike or pannicle ripens, it must be very carefully gathered and sown in the autumn, at which time the roots of the original plants, which will now bear separating, should be divided, and transplanted, so as to form more rows; the roots of the smooth-stalked meadow-grass, in particular, creeping like couch-grass, may readily be increased in this way; and thus by degrees a large plantation of these grasses may be formed and much seed collected.

"While the seeds are thus increasing, the piece or pieces of ground, which are intended to be laid down, should be got in order. If very foul, perhaps the best practice (if pasture land) will be to pare off the sward and burn it on the ground; or if this should not be thought advisable, it will be proper to plough up the ground and harrow it repeatedly, burning the roots of couch-grass and other noxious plants till the ground is become tolerably clean; to render it perfectly so, some cleansing crop, as potatoes or turnips, should be planted or sown.

"By this means, the ground we propose laying down will be got into excellent order without much loss; and being now ready to form into a meadow or pasture, should be sown broad-cast with the following compositions:

Meadow fox-tail, one pint;
Meadow fescue, ditto;
Smooth-stalked meadow, half a pint;
Rough-stalked meadow, ditto;
Crested dog's-tail, a quarter of a pint;
Sweet-scented vernal, ditto;
Dutch clover (*trifolium repens*), half a pint;
Wild red clover (*trifolium pratense*), or in its stead,
Broad clover of the shops, ditto;
For wet land, the crested dog's-tail and smooth-stalked meadow may be omitted, especially the former.

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"Such a composition as this, sown in the proportion of about three bushels to an acre on a suitable soil, in a favourable situation, will, I am bold to assert, form in two years a most excellent meadow; and, as all the plants sown are strong hardy perennials, they will not easily suffer their places to be usurped by any noxious plants, which by manure or other means, in spite of all our endeavours, will be apt to insinuate themselves; if they should, they must be carefully extirpated; for such a meadow is deserving of the greatest attention; but if that attention cannot be bestowed on it, and in process of time weeds should predominate over the crop originally sown, the whole should be ploughed up and fresh sown with the same seeds, or with a better composition, if such shall be discovered; for I have no doubt but, at some future time, it will be as common to sow a meadow with a composition somewhat like this, as it now is to sow a field with wheat or barley.

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When the
watering of
meadows
was first
practised in
England.

"One of the most important improvements in agriculture that has occurred of late years, is the practice of overflowing or flooding grass lands, which is now coming greatly into use, not only on level grounds, but in all situations in which a command of water can be obtained. In the Monthly Review for October 1788, the editors acknowledge the favour of a correspondent, who informed them, that watering of meadows was practised during the reigns of Queen Elizabeth and James I. A book was written upon the subject by one Rowland Vaughan, who seems to have been the inventor of this art, and who practised it on a very extensive plan in the Golden Valley in Herefordshire. Till this note to the Reviewers appeared, the inhabitants of a village called South Cerney in Gloucestershire had assumed the honour of the invention to themselves, as we are informed in a treatise upon the subject by the Rev. Mr Wright, curate of the place. According to a received tradition in that village, watering of meadows has been practised there for about a century, and was introduced by one *Welladvice*, a wealthy farmer in South Cerney. His first experiment was by cutting a large ditch in the middle of his ground, from which he threw the water over some parts, and allowed it to stagnate in others: but finding this not to answer his expectations, he improved his method by cutting drains and filling up the hollows; and thus he succeeded so well, that his neighbours, who at first called him a madman, soon changed their opinion, and began to imitate his example.

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Advantages
of water-
ing.

"The advantages which attend the watering of meadows are many and great; not only as excellent crops of grass are thus raised, but as they appear so early, that they are of infinite service to the farmers for food to their cattle in the spring before the natural grass rises. By watering we have plenty of grass in the beginning of March, and even earlier when the season is mild. The good effects of this kind of grass upon all sorts of cattle are likewise astonishing, especially upon such as have been hardly wintered; and Mr Wright informs us, that the farmers in his neighbourhood, by means of watering their lands, are enabled to begin the making of cheese at least a month sooner than their neighbours who have not the same advantage. Grass raised by watering is found to be admirable for the nurture of lambs: not only those designed for fattening, but such as are to be kept for store: For if

lambs when very young are stopped and stinted in their growth, they not only become contracted for life themselves, but in some measure communicate the same diminutive size to their young. The best remedy for preventing this evil is the spring feed from watered meadows; and Mr Wright is of opinion, that if the young of all kinds of farmers stock were immediately encouraged by plenty of food, and kept continually in a growing state, there would in a few years be a notable change both in the size and shape of cattle in general. Such indeed is the forwardness of grass from watered meadows, that the feed between March and May is worth a guinea per acre; and in June an acre will yield two tons of hay, and the after-math is always worth twenty shillings; and nearly the same quantity is constantly obtained whether the summer be dry or wet. In dry summers, also, such farmers as water their meadows have an opportunity of selling their hay almost at any price to their neighbours.

"Land treated in this manner is continually improving in quality, even though it be mown every year: the herbage, if coarse at first, becomes finer; the soil, if swampy, becomes sound; the depth of its mould is augmented, and its quality meliorated every year. "To these advantages (says Mr Boswell in his treatise upon this subject) another may be addressed to the gentleman who wishes to improve his estate, and whose benevolent heart prompts him to extend a charitable hand to the relief of the industrious poor, and not to idleness and vice: almost the whole of the expence in this mode of cultivation is the actual manual labour of a class of people who have no genius to employ their bodily strength otherwise for their own support and that of their families; consequently when viewed in this light, the expence can be but comparatively small, the improvement great and valuable."

As a proof of the above doctrine, Mr Wright adduces an instance of one year's produce of a meadow in his neighbourhood. It had been watered longer than the eldest person in the neighbourhood could remember; but was by no means the best meadow upon the stream, nor was the preceding winter favourable for watering. It contains six acres and a half. The spring feed was let for seven guineas, and supported nearly 200 sheep from the 1st of March till the beginning of May: the hay being sold for 30 guineas, and the after-math for six. Another and still more remarkable proof of the efficacy of watering, is, that two of the most skilful watermen of that place were sent to lay out a meadow of seven acres, the whole crop of which was that year sold for two pounds. Though it was thought by many impossible to throw the water over it, yet the skill of the workmen soon overcame all difficulties; and ever since that time the meadow has been let at the rent of three pounds per acre. From manifold experience, our author informs us, that the people in that part of the country are so much attached to the practice of watering, that they never suffer the smallest spring or rivulet to be unemployed. Even those temporary floods occasioned by sudden showers are received into proper ditches, and spread equally over the lands untill their fertilizing property be totally exhausted. "Necessity (says he) indeed compels us

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Land con-
stantly im-
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Example of
the produce
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to make the most of every drop : for we have near 300 acres in this parish, that must all, if possible, be watered ; and the stream that affords the water seldom exceeds five yards in breadth and one in depth ; therefore we may say, that a scarcity of water is almost as much dreaded by us as by the celebrated inhabitants of the banks of the Nile."

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The practice of watering ought to be more generally extended.

Considering the great advantages to be derived from the practice of watering meadows, and the many undoubted testimonies in its favour, Mr Wright expresses his surprise, that it has not come into more general use, as there is not a stream of water upon which a mill can be erected but what may be made subservient to the enriching of some land, perhaps to a great quantity. " I am confident (says he), that there are in each county of England and Wales 2000 acres upon an average which might be thus treated, and every acre increased at least one pound in annual value. The general adoption therefore of watering is capable of being made a national advantage of more than 100,000l. per annum, besides the great improvement of other land arising from the produce of the meadows and the employment of the industrious poor. Such an improvement, one would think, is not unworthy of public notice ; but if I had doubled the sum, I believe I should not have exceeded the truth, though I might have gone beyond the bounds of general credibility. In this one parish where I reside there are about 300 acres now watered ; and it may be easily proved that the proprietors of the land reap from thence 1000l. yearly profit."

In Mr Boswell's treatise upon this subject, published in 1790, the author complains of the neglect of the practice of improving the wet, boggy, and rushy lands, which lie at the banks of rivers, and might be meliorated at a very small expence, when much larger sums are expended in the improvement of barren uplands and large tracts of heath in various parts of the kingdom : and he complains likewise of the little information that is to be had in books concerning the method of performing this operation. The only author from whom he acknowledges to have received any information is Blyth ; and even his method of watering is very different from that practised in modern times ; for which reason he proposes to furnish an original treatise upon the subject ; and of this we shall now give the substance.

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Land capable of being watered.

The first thing to be considered is, what lands are capable of being watered. These, according to Mr Boswell, are all such as lie low, near the banks of rivulets and springs, especially where the water course is higher than the lands, and kept within its bounds by banks. If the rivulet has a quick descent, the improvements by watering will be very great, and the expences moderate. On level lands the water runs but slowly, which is also the case with the large rivers ; and therefore only a small quantity of ground can be overflowed by them in comparison of what can be done in other cases : but the water of large rivers is generally possessed of more fertilizing properties than that of rivulets. In many cases, however, the rivers are navigable, or have mills upon them ; both of which are strong objections to the perfect improvement of lands adjacent to them. From these considerations, our author concludes, that the watering of lands may be per-

formed in the best and least expensive manner by small rivulets and springs.

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There are three kinds of soils commonly found near the banks of rivers and rivulets, the melioration of which may be attempted by watering. 1. A gravelly or sound warm firm soil, or a mixture of the two together. This receives an almost instantaneous improvement ; and the faster the water runs over it the better. 2. Boggy, miry, and rushy soils, which are always found by the banks of rivers where the land is nearly level. These also are greatly improved by watering : perhaps equally so with those already described, if we compare the value of both in their unimproved state, this kind of ground being scarce worth any thing in its unimproved state. By proper watering, however, it may be made to produce large crops of hay, by which horned cattle may be kept through the winter and greatly forwarded ; though in its uncultivated state, it would scarce produce any thing to maintain stock in the winter, and very little even in summer. Much more skill, as well as expence, however, is requisite to bring this kind of land into culture than the former. 3. The soils most difficult to be improved are strong, wet, and clay soils ; and this difficulty is occasioned both by their being commonly on a dead level, which will not admit of the water running over them ; and by their tenacity, which will not admit of draining. Even when the utmost care is taken, unless a strong body of water is thrown over them, and that from a river the water of which has a very fertilizing property, little advantage will be gained ; but wherever such advantages can be had in the winter, and a warm spring succeeds, these lands will produce very large crops of grass.

The advantage of using springs and rivulets for watering instead of large rivers is, that the expence of raising wares across them will not be great ; nor are they liable to the other objections which attend the use of large rivers. When they run through a cultivated country also, the land floods occasioned by violent rains frequently bring with them such quantities of manure as contribute greatly to fertilize the lands, and which are totally lost where the practice of watering is not in use.

Springs may be useful to the coarse lands that lie near them, provided the water can be had in sufficient quantity to overflow the lands. " By springs (says our author), are not here meant such as rise out of poor heath or boggy lands (for the water issuing from them is generally so small in quantity, and always so very lean and hungry in quality, that little if any advantage can be derived from it) ; but rather the head of rivulets and brooks arising out of a chalky and gravelly sound firm soil, in a cultivated country. These are invaluable ; and every possible advantage should be taken to improve the ground near them. The author knows a considerable tract of meadow-land under this predicament ; and one meadow in particular that is watered by springs issuing immediately out of such a soil, without any advantage from great towns, &c. being situated but a small distance below the head of the rivulet, and the rivulet itself is fed all the way by springs rising out of its bed as clear as crystal. The soil of the meadow is a good loam some inches deep, upon a fine springy gravel. Whether it is from the

heat

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heat of the springs, or whether the friction by the water running over the soil raises a certain degree of warmth favourable to vegetation, or from whatever cause it arises, the fecundity of this water is beyond conception; for when the meadow has been properly watered and well drained, in a warm spring, the grass has been frequently cut for hay within five weeks from the time the stock was taken out of it, having ate it bare to the earth: almost every year it is cut in six weeks, and the produce from one to three waggon loads to an acre. In land thus situated, in the mornings and evenings in the months of April, May, and June, the whole meadow will appear like a large furnace; so considerable is the steam or vapour which arises from the warmth of the springs acted upon by the sun-beams: and although the water is so exceeding clear, yet upon its being thrown over the land only a few days in warm weather, by dribbling through the grass, so thick a scum will arise and adhere to the blades of the grass, as will be equal to a considerable quantity of manure spread over the land, and (it may be presumed from the good effects) still more enriching.

"It is inconceivable what 24 hours water properly conveyed over the lands will do in such a season: a beautiful verdure will arise in a few days where a parched rusty soil could only be seen; and one acre will then be found to maintain more stock than ten could do before."

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Explanation of
the terms used
in water-
ing.

Mr Boswell next proceeds to an explanation of the terms used in this art; of the instruments necessary to perform it; and of the principles on which it is founded. The terms used are:

1. A WARE. This is an erection across a brook, rivulet, or river, frequently constructed of timber, but more commonly of bricks or stones and timber, with openings to let the water pass, from two to ten in number according to the breadth of the stream: the height being always equal to the depth of the stream compared with the adjacent land. The use of this is occasionally to stop the current, and to turn it aside into the adjacent lands.

2. A SLUICE is constructed in the same manner as a ware; only that it has but a single passage for the water, and is put across small streams for the same purpose as a ware.

3. A TRUNK is designed to answer the same purposes as a sluice; but being placed across such streams as either cattle or teams are to pass over, or where it is necessary to carry a small stream at right angles to a large one to water some lands lower down, is for these reasons made of timber, and is of a square figure. The length and breadth are various, as circumstances determine.

4. A CARRIAGE is made of timber or of brick. If of timber, oak is the best; if of brick, an arch ought to be thrown over the stream that runs under it, and the sides bricked up: But when made of timber, which is the most common material, it is constructed with a bottom and sides as wide and high as the main in which it lies. It must be made very strong, close, and well jointed. Its use is to convey the water in one main over another, which runs at right angles to it; the depth and breadth are the same with those of the main to which it belongs: and the length is determined by

that which it crosses. The carriage is the most expensive instrument belonging to watering.

5. A DRAIN-SLUICE, or *Drain-Trunk*, is always placed in the lower part of some main, as near to the head as a drain can be found; that is, situated low enough to draw the main, &c. It is made of timber, of a square figure like a trunk, only much smaller. It is placed with its mouth at the bottom of the main, and let down into the bank; and from its other end a drain is cut to communicate with some trench-drain that is nearest. The dimensions are various, and determined by circumstances. The use of it is, when the water is turned some other way, to convey the leaking water that oozes through the hatches, &c. into the drain, that otherwise would run down into the tails of those trenches which lie lowest, and there poach and rot the ground, and probably contribute not a little to the making it more unsound for sheep. This operation is of the utmost consequence in watering; for if the water be not thoroughly drained off the land, the soil is rotted; and when the hay comes to be removed, the wheels of the carriages sink, the horses are mired, and the whole load sometimes sticks fast for hours together. On the other hand, when the drain trunks are properly placed, the ground becomes firm and dry, and the hay is speedily and easily removed.

6. HATCHES are best made of oak, elm, or deal; the use of them is to fit the openings of wares, trunks, or sluices; and to keep back the water when necessary, from passing one way, to turn it another. They ought to be made to fit as close as possible. When hatches belong to wares that are erected across large streams, or where the streams swell quickly with heavy rains, when the hatches are in their places to water the meadows, they are sometimes made so, that a foot or more of the upper part can be taken off, so that vent may be given to the superfluous water, and yet enough retained for the purpose of watering the meadows. In this case, they are called *flood-hatches*: but Mr Boswell entirely disapproves of this construction, and recommends them to be made entire, though they should be ever so heavy, and require the assistance of a lever to raise them up. For when the water is very high, and the hatches are suddenly drawn up, the water falls with great force upon the bed of the ware, and in time greatly injures it: but when the whole hatch is drawn up a little way, the water runs off at the bottom, and does no injury.

8. A HEAD-MAIN, is a ditch drawn from the river, rivulet, &c. to convey the water out of its usual current, to water the lands laid out for that purpose, by means of lesser mains and trenches. The head-main is made of various dimensions, according to the quantity of land to be watered, the length or descent of it, &c. Smaller mains are frequently taken out of the head one; and the only difference is in point of size, the secondary mains being much smaller than the other. They are generally cut at right angles, or nearly so, with the other, though not invariably. The use of the mains, whether great or small, is to feed the trenches with water, which branch out into all parts of the meadow, and convey the water to float the land. By some, these smaller mains are improperly called *carriages*.

9. A TRENCH is a small ditch made to convey the water

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water out of the mains for the immediate purpose of watering the land. It ought always to be drawn in a straight line from angle to angle, with as few turnings as possible. It is never deep, but the width is in proportion to the length it runs, and the breadth of the plane between that and the trench drain. The breadth tapers gradually to the lower end.

10. A TRENCH DRAIN is always cut parallel to the trench, and as deep as the tail-drain water will admit, when necessary. It ought always, if possible, to be cut down to a stratum of sand, gravel, or clay. If into the latter, a spade's depth into it will be of great advantage. The use of it is to carry away the water immediately after it has run over the panes from the trench. It need not to be drawn up to the head of the land by five, six, or more yards, according to the nature of the soil. Its form is directly the reverse of the trench; being narrower at the head, and growing gradually wider and wider until it empties itself into the tail-drain.

11. The TAIL-DRAIN is designed as a receptacle for all the water that flows out of the other drains, which are so situated that they cannot empty themselves into the river. It should run, therefore, nearly at right angles with the trenches, though generally it is thought most eligible to draw it in the lowest part of the ground, and to use it to convey the water out of the meadows at the place where there is the greatest descent; which is usually in one of the fence-ditches: and hence a fence-ditch is usually made use of instead of a tail-drain, and answers the double purpose of fencing a meadow, and draining it at the same time.

12. A PANE of ground is that part of the meadow which lies between the trench and the trench drain; and in which the grass grows for hay. It is watered by the trenches, and drained by the trench-drains; whence there is a pane on each side of every trench.

13. A WAY-PANE is that part of the ground which lies, in a properly watered meadow, on the side of the main where no trenches are taken out, but is watered the whole length of the main over its banks. A drain for carrying off the water from this pane runs parallel to the main. The use is to convey the hay out of the meadows, instead of the teams having to cross all the trenches.

14. A BEND is made in various parts of those trenches which have a quick descent, to obstruct the water. It is made, by leaving a narrow strip of green sward across the trench where the bend is intended to be left; cutting occasionally a piece of the shape of a wedge out of the middle of it. The use is to check the water, and force it over the trench into the panes; which, were it not for these bends, would run rapidly on in the trench, and not flow over the land as it passes along. The great art in watering consists in giving to each part of the panes an equal proportion of water.

15. A GUTTER is a small groove cut out from the tails of these trenches where the panes run longer at one corner than the other. The use is to carry the water to the extreme point of the pane. Those panes which are intersected by the trench and tail-drains, meeting in an obtuse angle, require the assistance of gutters to convey the water to the longest side. They are likewise useful, when the land has not been so well

levelled, but some part of the panes lie higher than they ought: in which case, a gutter is drawn from the trench over that high ground, which otherwise would not be overflowed. Without this precaution, unless the flats be filled up (which ought always to be done when materials can be had to do it) the water will not rise upon it; and after the watering season is past, those places would appear rusty and brown, while the rest is covered with beautiful verdure. Our author, however, is of opinion, that this method of treating water meadows ought never to be followed; but that every inequality in water meadows should either be levelled, or filled up. Hence the waterman's skill is shown in bringing the water over those places to which it could not naturally rise, and in carrying it off from those where it would naturally stagnate.

16. A CATCH-DRAIN is sometimes made use of when water is scarce. When a meadow is pretty long, and has a quick descent, and the water runs quickly down the drains, it is customary to stop one or more of them at a proper place, till the water flowing thither rises so high as to strike back either into the tail drains so as to stagnate upon the sides of the panes, or till it flows over the banks of the drains, and waters the ground below, or upon each side. It is then to be conveyed over the land in such quantity as is thought proper, either by a small main, out of which trenches are to be cut with their proper drains, or by trenches taken properly out of it. In case of a stagnation, the design will not succeed; and it will then be necessary to cut a passage to let the stagnating water run off. Even when the method succeeds best, Mr Boswell is of opinion, that it is not by any means eligible; the water having been so lately strained over the ground, that it is supposed by the watermen not to be endowed with such fertilizing qualities as at first; whence nothing but absolute necessity can justify the practice.

17. A POND is any quantity of water stagnating upon the ground, or in the tail-drain, trench-drains, &c. so as to annoy the ground near them. It is occasioned sometimes by the flats not having been properly filled up; at others, when the ware not being close shut, in order to water some grounds higher up, the water is thereby thrown back upon the ground adjacent.

18. A TURN of water signifies as much ground as can be watered at once. It is done by shutting down the hatches in all those wares where the water is intended to be kept out, and opening those that are to let the water through them. The quantity of land to be watered at once must vary according to circumstances; but Mr Boswell lays down one general rule in this case, viz. that no more land ought to be kept under water at one time than the stream can supply regularly with a sufficient quantity of water; and if this can be procured, water as much ground as possible.

19. The HEAD of the meadow, is that part of it into which the river, main, &c. first enter.

20. The TAIL is that part out of which the river, &c. last passes.

21. The UPPER SIDE of a main or trench, is that side which (when the main or trench is drawn at right angles, or nearly so, with the river) fronts the part where the river entered. The lower side is the opposite.

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22. The **UPPER PANE** in a meadow is that which lies on the upper side of the main or trench that is drawn at right angles with the river: where the river runs north and south, it enters in the former direction, and runs out in the southern, the main and trenches running east and west. Then all those panes which lie on the north side of the mains are called *upper panes*; and those on the south side the *lower panes*. But when the mains, trenches, &c. run parallel to the river, there is no distinction of panes into upper and lower.

The instruments used in watering meadows are.

1. A *Water-level*. The use of this is to take the level of the land at a distance, and compare it with that of the river, in order to know whether the ground can be overflowed by it or not. This instrument, however, is used only in large undertakings; for such as are on a smaller scale, the workmen dispense with it in the following manner: In drawing a main, they begin at the head, and work deep enough to have the water follow them. In drawing a tail drain, they begin at the lower end of it, and work upwards, to let the tail water come after them. By this method we obtain the most exact level.

2. The *Line, Reel, and Breast-Plough*, are absolutely necessary. The line ought to be larger and stronger than that used by gardeners.

3. *Spades*. Those used in watering meadows are made of a particular form, on purpose for the work; having a stem considerably more crooked than those of any other kind. The bit is iron, about a foot wide in the middle, and terminating in a point: a thick ridge runs perpendicularly down the middle, from the stem almost to the point. The edges on both sides are drawn very thin, and being frequently ground and whetted, the whole soon becomes narrow; after which the spades are used for trenches and drains; new ones being procured for other purposes. The stems being made crooked, the workmen standing in the trench or drains, are enabled to make the bottoms quite smooth and even.

4. *Wheel and Hand-barrows*. The former are used for removing the clods to the flat places, and are quite open, without any sides or hinder part. The latter are of service where the ground is too soft to admit the use of wheel-barrows, and when clods are to be removed during the time that the meadow is under water.

5. *Three-wheeled Carts* are necessary when large quantities of earth are to be removed: particularly when they are to be carried to some distance.

6. Short and narrow *Scythes* are made use of to mow the weeds and grass, when the water is running in the trenches, drains, and mains.

7. *Forks*, and long *Crooks* with four or five tines, are used for pulling out the roots of sedges, rushes, reeds, &c. which grow in the large mains and drains. The crooks should be made light, and have long stems to reach wherever the water is so deep that the workmen cannot work in it.

8. Strong *Water-boots*, the tops of which will draw up half the length of the thigh, are indispensably necessary. They must also be large enough to admit a quantity of hay to be stuffed down all round the legs, and be kept well tallowed to resist the running water for many hours together.

The principles on which the practice of watering meadows depends are few and easy.

1. Water will always rise to the level of the receptacle out of which it is originally brought.

2. There is in all streams a descent greater or smaller; the quantity of which is in some measure shown by the running of the stream itself. If it run smooth and slow, the descent is small; but if rapidly and with noise, the descent is considerable.

3. Hence if a main be taken out of the river high enough up the stream, water may be brought from that river to flow over the land by the side of the river, to a certain distance below the head of the main, although the river from whence it is taken should, opposite to that very place, be greatly under it.

4. Water, sunk under a carriage which conveys another stream at right angles over it, one, two, or more feet below its own bed, will, when it has passed the carriage, rise again to the level it had before.

5. Water conveyed upon any land, and left there stagnant for any length of time, does it an injury: destroying the good herbage, and filling the place with rushes, flags, and other weeds.

6. Hence it is absolutely necessary, before the work is undertaken, to be certain that the water can be thoroughly drained off.

In Mr Wright's treatise upon this subject, the author considers a solution of the three following questions as a necessary preliminary to the operation of watering. 1. Whether the stream of water will admit of a temporary dam or ware across it? 2. Can the farmer raise the water by this means a few inches above its level, without injuring his neighbour's land? 3. Can the water be drawn off from the meadow as quick as it is brought on? If a satisfactory answer can be given to all these questions, he directs to proceed in the following manner.

Having taken the level of the ground, and compared it with the river, as directed by Mr Boswell, cut a deep wide ditch as near the dam as possible, and by it convey the water directly to the highest part of the meadow; keeping the sides or banks of the ditch of an equal height, and about three inches higher than the general surface of the meadow. Where the meadow is large, and has an uneven surface, it will sometimes be necessary to have three works in different directions, each five feet wide, if the meadow contains 15 acres, and if the highest part be farthest from the stream. A ditch of 10 feet wide and three deep will commonly water 10 acres of land. When there are three works in a meadow, and flood-hatches at the mouth of each, when the water is not sufficient to cover the whole completely at once, it may be watered at three different times, by taking out one of the hatches, and keeping the other two in. In this case, when the water has run over one division of the land for 10 days, it may then be taken off that and tumbled over to another, by taking up another hatch and letting down the former; by which means the three divisions will have a proper share of the water alternately, and each reap equal benefit. The bottom of the first work ought to be as deep as the bottom of the river, when the fall of the meadow will admit of it; for the deeper the water is drawn, the more mud it carries along

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along with it. From the works, cut at right angles, smaller ditches or troughs, having a breadth proportioned to the distance to which some part of the water is to be carried, their distance from each other being about 12 yards. A trough two feet wide, and one foot deep, will water a surface 12 yards wide and 40 feet long. In each trough as well as ditch place frequent stops and obstructions, especially when the water is rapid, to keep it high enough to flow through the notches or over the sides. Each ditch and trough is gradually contracted in width, as the quantity of water constantly decreases the farther they proceed. Between every two troughs, and at an equal distance from both, cut a drain as deep as you please parallel to them, and wide enough to receive all the water that runs over the adjacent lands, and to carry it off into the master-drain with such rapidity as to keep the whole sheet of water in constant motion; and if possible not to suffer a drop to stagnate upon the whole meadow. "For a stagnation (says he), though it is recommended by a Mr D. Young for the improvement of arable land, is what we never admit in our system of watering; for we find that it rots the turf, soaks and starves the land, and produces nothing but coarse grass and aquatic weeds.

"When a meadow lies cold, flat, and swampy, the width of the bed, or the distance between the trough and drain, ought to be very small, never exceeding six yards: indeed, in this case, you can scarcely cut your land too much, provided the water be plentiful; for the more you cut, the more water you require. The fall of the bed in every meadow should be half an inch in a foot: less will do, but more is desirable; for when the draught is quick, the herbage is always fine and sweet. The water ought never to flow more than two inches deep, nor less than one inch, except in the warm months."

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Mr Wright proceeds now to answer some objections made by the Reviewers in their account of the first edition of his work. 1. That the Gloucestershire farmers use more water for their lands than is necessary. To this it is answered, That where water is plentiful, they find it advantageous to use even more water than he recommends; and when water is scarce, they choose rather to water only one half, or even a smaller portion of a meadow at a time, and to give that a plentiful covering, than to give a scanty one to the whole. 2. The Reviewers likewise recommend a repeated use of the same water upon different and lower parts of the same meadow, or to make each drain serve as a trough to the bed which is below it. But though this method is in some degree recommended by the celebrated Mr Bakewell, and taught by a systematic waterer in Staffordshire, he entirely disapproves of it; excepting where the great declivity of the land will not admit of any other plan. "This cannot (says he) be a proper mode of watering grass-land in the winter time; for it can be of no service to the lowest parts of the meadow, unless as a wetting in spring or summer. The first or highest part of a meadow laid out according to this plan will indeed be much improved; the second may reap some benefit; but the third, which receives the exhausted thin cold water, will produce a very unprofitable crop. Our farmers never

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choose more than a second use in the same meadow, and that very seldom; they call even the second running by the significant name of *small beer*; which, they say, may possibly satisfy thirst, but can give very little life or strength to land. It is a much better method to have a meadow laid out so as to be watered at several times, and to be at the expence of several small flood-hatches, than to water the whole of it at once by means of catch-drains.

"Sometimes it is necessary, in a large meadow, to convey the water that has been used under the works and troughs; and then the water above is supported by means of boards and planks, which we call a *carry-bridge*. Sometimes, the better to regulate the course of the water of the surfacc, especially in the spring, narrow trenches are dug, and the mould laid by the side of them, in order to be restored to its former place when the watering is finished. The earth and mud thrown out in cleansing and paring the ditches should be carried to fill up the low hollow parts of the meadow, and be trodden down with an even surface; which will easily be done when the water is on, the watermen being always provided with a strong pair of water-proof boots. If the mould thus used has upon it a turf that is tolerably fine, place it uppermost; but if it is sedgy and coarse, turn it under, and the water if it runs quick will soon produce a fine herbage upon it.

The grounds that are watered in the easiest and most effectual manner, are such as have been ploughed and ridged up in lands about twelve yards wide. Here the water is easily carried along the ridge by means of a small ditch or trough cut along its summit, and then, by means of the stops in it, is made to run down the sides or beds into the furrows, by which it is carried into the master-drain, which empties itself into the river. Every meadow, before it is well watered, must be brought into a form something like a field that has been thus left by the plough in a ridged state. Each side of the ridge should be as nearly as possible an exact inclined plane, that the water may flow over it as equally as may be." Mr Wright does not, like Mr Boswell, disapprove of the use of flood-hatches; he only gives the following hint, viz. that their basis should be deep and firmly fixed, well secured with stone and clay, that it be not blown up. The following directions are given for each month of watering.

In the beginning of November, all the ditches, troughs, and drains, are to be thoroughly cleansed by the spade and breast-plough, from weeds, grass, and mud; and well repaired, if they have received any injury from cattle. After a shower, when the water is thick and muddy, turn over the meadow as much water as you can without injuring the banks of the works, especially if the land be poor; as in this month, according to our author, the water contains many more fertilizing particles, which he calls *salts* and *richness*, than later in the winter. In defence of this position, of which it seems the Monthly Reviewers have doubted, our author urges, that though he is not able to prove it by any chemical analysis, yet it seems evident, that "after the first washing of farm yards, various sinks, ditches, and the surface of all the adjoining fields, which have lain dry for some time, the common stream should then contain much more fatness

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than when the same premises have been repeatedly washed." This is confirmed by the experience of the Gloucestershire farmers; who, if they can at this season of the year procure plenty of muddy water to overflow their grounds for one week, look upon it to be equally valuable with what is procured during all the rest of the winter. In support of this, he quotes the following words of Mr Forbes, in a treatise on watering: "The water should be let in upon the meadow in November, when the first great rains make it muddy, for then it is full of a rich sediment, brought down from the lands of the country through which it runs, and is washed into it by the rain; and as the sediment brought by the first floods is the richest, the carriages and drains of the meadow should all be scoured clean and in order, before these floods come."

"In opposition (adds Mr Wright) to the opinion of practical waterers, that the muddiness of the water is of little consequence, I hesitate not to affirm, that the mud is of as much consequence in winter-watering, as dung is in the improvement of a poor upland field. For each meadow in this neighbourhood is fruitful in proportion to the quantity of mud that it collects from the water. And, indeed, what can be conceived more enriching than the abundant particles of putrid matter which float in the water, and are distributed over the surface of the land, and applied home to the roots of the grass. It is true, that any the most simple water thrown over a meadow in proper quantity, and not suffered to stagnate, will shelter it in winter, and in the warmth of spring will force a crop; but this unusual force must exhaust the strength of the land, which will require an annual supply of manure in substance, or, in a course of years, the soil will be impaired rather than improved. The meadows in this county, which lie next below a market town or village, are invariably the best; and those which receive the water after it has been two or three times used, reap proportionably less benefit from it: For every meadow that is well laid out, and has any quantity of grass upon its surface, will act as a fine sieve upon the water, which, though it flow in ever so muddy, will be returned back to the stream as clear as it came from the fountain. This circumstance, when there is a range of meadows to be watered, the property of different persons, when water is scarce, creates vehement contentions and struggles for the first use of it. The proprietors are therefore compelled to agree among themselves, either to have the first use alternately, or for the higher meadows to dam up, and use only one half or a less portion of the river. Our farmers know the mud to be of so much consequence in watering, that whenever they find it collected at the bottom of the river, or the ditches, they hire men whole days to disturb and raise it with rakes made for the purpose, that it may be carried down by the water, and spread upon their meadows. One meadow in South Cerney, I think, is an incontestable proof of the consequence of muddy water. It is watered by a branch of the common stream that runs for about half a mile down a public road. This water, by the mud on the road being continually disturbed by carriages and the feet of cattle becomes very thick, and when it enters the meadow is almost as white as milk. This field, which consists of seven acres, was a few years ago let for 10s.

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an acre, but is already become the richest land in the parish, and has produced at one crop eighteen loads of hay, and each load more than 25 hundred weight."

In further confirmation of what our author asserts, he quotes, from the Annals of Agriculture, the following words of Mr Wimpey: "As to the sorts of water, little is to be found, I believe, which does not encourage and promote vegetation, even the most simple, elementary, and uncompounded fluid: heat and moisture, as well as air, are the *sine qua non* of vegetation as well as animal life. Different plants require different proportions of each to live and flourish; but some of each is absolutely necessary to all. However, experience as well as reason universally shows, that the more turbid, feculent, and replete with putrescent matter the water is, the more rich and fertilizing it proves. Hasty and impetuous rains, of continuance sufficient to produce a flood, not only dissolve the salts, but wash the manure in substance off the circumjacent land into the rapid current. Such turbid water is both meat and drink to the land; and, by the unctuous sediment and mud it deposits, the soil is amazingly improved and enriched. The virtue of water from a spring, if at all superior to pure elementary water, is derived from the several strata or beds of earth it passes through, which, according to the nature of such strata, may be friendly or otherwise to vegetation. If it passes through chalk, marl, fossil shells, or any thing of a calcareous nature, it would in most soils promote the growth of plants; but if through metallic ores, or earth impregnated with the vitriolic acid, it would render the land unfertile, if not wholly barren. In general the water that has run far is superior to that which immediately flows from the spring, and more especially that which is feculent and muddy, consisting chiefly of putrid animal substances washed down the stream."

To the same purpose also, says Mr Forbes: "There is great difference in the quality of water, arising from the particles of different kinds of matter mixed with them. Those rivers that have a long course through good land, are full of fine particles, that are highly fertilizing to such meadows as are usually overflowed by them; and this chiefly in floods, when the water is fullest of a rich sediment: for when the water is clear, though it may be raised by art high enough to overflow the adjoining lands, and be of some service to them, the improvement thus made is far short of what is obtained from the same water when it is thick and muddy."

Mr Boswell, though quoted by Mr Wright as an advocate for the doctrine just now laid down, seems, in one part of his work at least, to be of a contrary opinion. This is in the 14th chapter of his book, where he remarks upon another publication on the same subject, the name of which he does not mention: "In page 4. of that pamphlet (says Mr Boswell) the writer informs us, 'if the water used be always pure and simple, the effect will by no means be equal to the above; that is, of a stream that is sometimes thick and muddy. We have a striking instance of this in two of our meadows, which are watered immediately from springs that arise in the grounds themselves. Their crops are early and plentiful, but not of a good quality, and the land remains unimproved after many years watering.'

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"The writer of this treatise (Mr Boswell), in a former edition, had asserted, and in this repeated, the contrary effects from a stream very near the spring-head, as clear as crystal.

"The gentleman (Mr Beverly of Keld) whom that writer mentions in his preface, made a short visit last spring into Dorsetshire, to satisfy himself of the fact. The editor had the pleasure to shew him the stream alluded to, which he traced almost to the fountain-head. It was perfectly clear, and the water was then immediately conveyed out of the stream upon the lands adjoining, some of which it was then running over; others it had been upon, and the verdure was then appearing. The gentleman expressed himself perfectly satisfied with the fact. To him the editor wishes to refer, &c. Mr George Culley of Fenton near Wooler in Northumberland, with a truly noble and public spirit that does him great honour as a friend to his country, sent a very sensible young man from thence into Dorsetshire, to learn the art of watering meadows, and to work the whole season in those meadows under different watermen. This man was often over those meadows, and worked in some just below that were watered by the same stream. Might the editor presume to offer his opinion upon this seeming contradiction, it is very probable that the soils, both the upper and under strata, are very different, as well as those through which the different springs run."

From this passage, the latter part of which is not very intelligible, we may conclude that Mr Boswell prefers clear to muddy water for overflowing meadows. In his chapter on land-floods, however, he expresses himself as follows: "They will (says he) always be found of great use where the sweepings of towns, farm-yards, &c. are carried down by them; seldom any other erection is wanting besides a sluice or small ware to divert and convey them over the lands. If the situation of the land happen to be on the side of a hill, catch-drains are absolutely necessary for watering the lower part of the hill, after the water has been used upon the upper. In many parts of the kingdom, where there are large hills or extensive rising lands, great quantities of water run from them into the valleys after heavy rains: These might with proper attention be collected together before they get to the bottom or flat ground, and from thence he diverted to the purpose of watering those lands that lie below, with great advantage to the occupier, and at a small expence. And should the land thus situated be arable, yet it would be found a beneficial exchange to convert it into pasture; particularly if pasture-ground should be a desirable object to the occupier. The method of performing it is thus recommended. Observe the piece of land or field best adapted to the purpose, both for situation and soil. If it should be arable, make it first very level; and with the crop of corn sow all sorts of hay seeds: and as soon as it has got a green sward it may be laid out. In the lowest part of the ground draw a deep ditch for the current to run in through it; and continue it into some ditch or low part in the lands below, that the water may be freely carried off, after it has been and while it is in use. Draw ditches above the field intended to be watered aslant the sides of the hill, in such a manner

that they may all empty themselves into the head of the ditch above mentioned, just where it enters the field to be watered; then erecting a ware across this ditch, the field will be capable of being watered, according to the situation of the ditch in the middle or on the side of the field. It must then be conveyed by small mains or trenches, and subdivided again by branch-trenches, according to the site of the field and quantity of water that can be collected; trench-drains must be drawn, and the water conveyed into the ditch by means of tail-drains. A person unacquainted with water-meadows cannot conceive the advantage arising from water thus collected, and conveyed over this species of water-meadow (if it may be so called), being generally a firm good soil; but the water running down from rich cultivated hills, eminences, &c. sweeps away with it, when the rain falls very heavy, vast quantities of dung dropped by sheep and other cattle, and the manure carried upon arable lands; all which being now diverted and carried over the meadow with an easy descent, gives time for the particles of manure to subside upon the ground at one season, or of being filtered from it as it dribbles through the grass at another; after which the warm weather pushes on vegetation amazingly. Meadows thus situated would be vastly superior to any other, if they had the advantage of a constant stream; but even as they are, taking the opportunity of watering them by every heavy rain or flood that happens, they will be found to be very valuable. The occupier of such lands is strenuously advised to let no time be lost in appropriating them to this use; because these lands are healthy for all kinds of cattle at almost all seasons; and the expence of converting them into this kind of water-meadow is exceeding small, the annual charges afterwards quite trifling, and the produce very considerable."

Mr Wright, having discussed the subject of the quantity of the water, proceeds to give directions for watering through the different months of the year.—
"In December and January, the chief care consists in keeping the land sheltered by the water from the severity of frosty nights. It is necessary, however, through the whole winter, every ten days or fortnight, to give the land air, by taking the water off entirely, otherwise it would rot and destroy the roots of the grass. It is necessary, likewise, that a proper person should go over every meadow at least twice every week, to see that the water is equally distributed, and to remove all obstructions arising from the continual influx of weeds, leaves, sticks, and the like. In February a great deal depends upon care and caution. If you now suffer the water to remain on the meadow for many days without intermission, a white scum is raised, very destructive to the grass; and if you take off the water, and expose the land to a severe frosty night, without its being previously dried for a whole day, the greatest part of the tender grass will be cut off. The only ways to avoid both these injuries are, either to take the water off by day to prevent the scum, and to turn it over again at night to guard against the frost; or, if this practice be too troublesome, both may be prevented by taking the water entirely off for a few days and nights, provided the first day of taking off be a dry one; for if the grass experience one fine drying

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drying day, the frost at night can do little or no injury. The scum is generated chiefly by the warmth of the sun, when the water is thin and used too plentifully. Towards the middle of this month we vary our practice in watering, by using only about half the quantity of water which is made use of earlier in the winter, all that is now required being to keep the ground in a warm moist state, and to force vegetation.

"At the beginning of March, the crop of grass in the meadows is generally sufficient to afford an abundant pasture for all kinds of stock, and the water is taken off for near a week, that the land may become dry and firm before the heavy cattle are turned in.— It is proper, the first week of eating off the spring-feed, if the season be cold, to give the cattle a little hay each night."

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with ewes
and lambs.

"It is a custom (says Mr Wright) with some farmers in Hampshire, to eat off the spring grass of their meadows with ewes and lambs, in the same manner that we do a field of turnips, by inclosing a certain portion each day with hurdles or stakes, and giving them hay at the same time. This is certainly making the most of the grass, and an excellent method to fine and sweeten the future herbage. In this month and April, you may eat the grass as short and close as you please, but never later; for if you trespass only one week on the month of May, the hay-crop will be very much impaired, the grass will become soft and woolly, and have more the appearance and quality of an after-math than a crop. At the beginning of May, or when the spring feeding is finished, the water is again used for a few days by way of wetting.

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occasion
the rot in
sheep.

"It is rather remarkable, that watering in autumn, winter, or spring, will not produce that kind of herbage which is the cause of the rot in sheep; but has been known to remove the cause from meadows, which before had that baneful effect. If, however, you use the water only a few days in any of the summer months, all the lands thus watered will be rendered unsafe for the pasturage of sheep. Of this I was lately convinced from an experiment made by a friend. At the beginning of July, when the hay was carried off, and the water rendered extremely muddy and abundant by several days rain, he thought proper to throw it over his meadows for ten days, in which time a large collection of extremely rich manure was made upon the land. In about a month the meadow was covered with uncommon luxuriance and blackness of herbage. Into this grass were turned eight sound ewes and two lambs. In six weeks time the lambs were killed, and discovered strong symptoms of rottenness; and in about a month afterwards one of the ewes was killed, and though it proved very fat, the liver was putrid and replete with the insect called the *fluke* or *weevil*: the other ewes were sold to a butcher, and all proved unsound. This experiment, however, convinces me, by the very extraordinary improvement made thereby in the meadow, that muddy water in the summer is much more enriching than it is in autumn or winter; and ought, therefore, to be used for a week at least every wet summer, notwithstanding its inconveniences to sheep, the most profitable species of stock."

Mr Boswell, besides his general directions for watering, gives many plans of the ditches, drains, &c.

for particular meadows, some of them done from an actual survey. But these being confined to particular situations, we shall here only speak of his method in general. In his third chapter, entitled *A general Description of Water-meadows*, he observes that "lands capable of being watered, lie generally only on one side, and sometimes on both sides of the stream designed to supply them with water. In the former case, when they have a pretty quick descent, the land may be often watered by a main drawn out of the stream itself, without any ware;" though he acknowledges that it is by far the best way to erect a ware, and to draw mains on each side, to dispose of the water to the best advantage.

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well's ge-
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tions for
watering.

Boggy lands require more and longer continued watering than such as are sandy or gravelly; and the larger the body of water that can be brought upon them, the better. The weight and strength of the water will greatly assist in compressing the soil, and destroying the roots of the weeds that grow upon it; nor can the water be kept too long upon it, particularly in the winter season; and the closer it is fed the better.

To improve strong clay soils, we must endeavour to the utmost to procure the greatest possible descent from the trench to the trench drain; which is best done by making the trench drains as deep as possible, and applying the materials drawn out of them to raise the trenches. Then, with a strong body of water, taking the advantage of the autumnal floods, and keeping the water some time upon them at that season, and as often as convenient during the winter, the greatest improvement on this sort of soils may be made. Warm sand, or gravelly soil, are the most profitable under the watering system, provided the water can be brought over them at pleasure. In soils of this kind, the water must not be kept long at a time, but often shifted, thoroughly drained, and the land frequently refreshed with it: under which circumstances the profit is immense. A spring-feeding, a crop of hay, and two after-maths, may be obtained in a year; and this, probably, where in a dry summer scarce grass enough could be found to keep a sheep alive. If the stream be large, almost any quantity of land may be watered from it; and though the expence of a ware over it is great, it will soon be repaid by the additional crop. If the stream is small, the expence will be so in proportion.

The following method of improving a water-meadow that was springy has been tried by Mr Boswell with success. The meadow had been many years watered by a spring rising just above it from a barren sandy heath; the soil near the surface was in some places a gravelly sand, in others a spongy cork, both upon a strong clay and sand mixture, which retained the draining of the lands above it. Whenever it had been watered, and left to drain itself dry, a yellowish red water stood in many parts, and oozed out of others; the herbage being no other than a poor, miserable, hairy grass and small sedge. Chalk and ashes had been thrown over it to very little purpose. It was then drained underground aslant all the different descents, and all these drains carried into one large drain, which had been already cut for the purpose of carrying off the water when the meadow was overflowed. These drains were cut quite through the mixture of clay and sand, and as much deeper as the fall of the ground below would

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dow.

^{Culture of} ^{Grass.} would admit of; then, with chalk cut for the purpose, small hollow drains were formed at the bottom of these; the drains were then filled up with the materials that came out.

This was done in the beginning of summer, and the work frequently examined through the season; the soil was found firmer than before, and none of that nasty red water to be met with upon the surface, though it continually oozed into the drains. In autumn the meadow was again prepared for waterings, by repairing those trenches and drains that were properly situated; and by cutting others where wanted, for the purpose of watering the meadow. The water being then brought over it from the same spring as before, the event answered the most sanguine wishes of the proprietor; the effects were visible the first year, and the ground has been constantly improving ever since.

⁴⁰⁷ ^{Of water-} ^{ing lands on} ^{the sides of} ^{hills.} Mr Boswell also informs us, that a gentleman in Scotland had applied to him for directions to water some lands lying on the sides of hills, where the descent is quick; and of which there are many in this country, as well as in the north of England. It would be difficult to water such lands by means of drains and trenches according to the directions already given; because the bends in the trenches must be very near together and large, as the water must flow out of the trench *above* the bend to flow over the pane below it; the number and size would likewise be inconvenient, and greatly offend the eye.

Lands of this sort are generally capable of being ploughed; in which case our author directs them to be once ploughed in the spring, and sown with oats or any other kind of grain that will rot the sward. When the grain is harvested, plough the land across; the last ploughing with the Kentish plough, which has a moveable mouldboard, and is called a *turn-wrist* plough. This turns the furrows down the side of the hill, the horses going forwards and backwards in the same furrows. By this means the land is laid flat without any open furrows in it: dress it down in the spring very fine, and sow it with oats, and mix with some kinds of grass seeds very thick. Thus the ground will have but few irregularities; and as soon as the corn is carried off, or the following spring at farthest, the mains and drains may be cut out.

⁴⁰⁸ ^{Of water-} ^{ing coarse} ^{grass.} For watering coarse lands that are firm enough to bear the plough, and situated near a stream, our author gives the following directions.

"Let the land thus situated be ploughed once in the spring, and sown with any grain that will rot the sward. As soon as the crop is off, plough it again, and leave it rough through the winter. Work it down early in the spring, and plough it in the direction the trenches are to lie, making the ridges of a proper size for watering, ten or twelve yards wide for instance; work it fine; then gather the ridges up again in the same manner, making the last furrows of each ridge as deep as possible. If the land be not fine, dress it down again, and gather it up a second time if necessary; and with a shovel throw the earth from the edges of the furrows to the tops of the ridges, to give the greatest possible descent from the trench to the drain. Sow it with oats and grass seeds very thick; and after the corn is carried off, the trenches may be formed upon the top of each ridge, dispersing the fur-

rows with a spade as much as the fall of the land will admit of for the drains; taking care to procure sufficient fall at all events, to drain the lands after they have been watered. By this method the crop of corn will nearly pay all the expence, and the land will be in excellent order."

After the work of watering a meadow is totally finished, and the hay carried off, cattle may be let in to eat the after-math. When this is done, it will then be necessary to examine whether or not the mains have suffered any injury from their feet; whether there be quantities of mud or sand collected at the angles, &c. all of which must be thrown out and the breaches repaired; by which means the trenches, drains, &c. will last three years, but otherwise not more than two. The roots, mud, &c. may be used in repairing the breaches, but never left upon the sides of the trenches out of which they are taken. The tail-drains require to be cleansed oftener than any of the other works, for this obvious reason, that the mud, &c. is carried down from all the others into them; where, if it be allowed to accumulate, it occasions a stagnation of water upon the meadow itself. In repairing the trenches, particular care ought to be taken that the workmen do not make them any wider than before, which they are very apt to do; neither are they to be allowed to throw the materials which they dig out in a ridge behind the edge of the trench, which both widens it and promotes weeds.

⁴⁰⁹ ^{Of the man-} ^{agement of mea-} ^{dows after} ^{watering.} During the time of watering, it will be necessary to examine the meadow every two or three days in order to remove obstructions, &c. If the drains should be filled with water and run over, they ought to be made deeper; or if this cannot be done, they should be widened. In the winter time a regular strong water should be kept, avoiding very strong great floods. In this season the water may be kept on the ground with safety for a month or even six weeks, if the soil be corky or boggy, or a strong clay; but not quite so long if it be gravel or sand. At the second watering a fortnight or three weeks will be sufficient; and after Candlemas a fortnight will be rather too long. At the third watering a week will be sufficient, which will bring it to about the middle of March; by which time, if the weather be tolerably mild, the grass will be long enough for the ewes and lambs, or fatting lambs; which may then be turned into the meadow with great advantage. Even in the end of February, if the winter has been very mild, the grass will be long enough for them. Here they may be permitted to feed till the beginning of May, changing them into different meadows. As soon as they are taken out, the water must be turned in for a week, carefully examining every trench and drain for the reasons already given. The water is then to be shifted into others, alternately watering and draining, lessening the time the water remains upon it as the weather grows warmer; and in five, six, or seven weeks, the grass will be fit to be mown for hay, and produce from one to two tons, or even more, an acre, upon good ground.

Mr Boswell directs, that about a week before the grass is to be mown, the water should be let into the meadow for 24 hours; which, he says will make the ground moist at the bottom, the scythe will go through

Culture of Grass. it the more easily, and the grass will be mown closer to the ground. This practice, however, is entirely disapproved of by Mr Wright. "Though it may prevail in Dorsetshire (says he), it is very seldom advisable, for the following reasons: Water made to run through a thick crop of grass, though it may appear ever so pure, will leave a certain quantity of adherent scum or sediment, which can never be separated from the hay, but will render it unpalatable, if not prejudicial, to the cattle that eat it. And this wetting of the land and grass will impede the drying or making of the hay perhaps some days, which in difficult seasons is of very great consequence, and it will likewise make the turf too soft and tender to support the wheels of a loaded waggon in carrying off the hay. Besides, there is reason to believe that one day's wetting in the summer, will, upon most meadows, endanger the soundness of every sheep that feeds upon the after-math."

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Of spring-feeding.

The spring-feeding ought never to be done by heavier cattle than sheep or calves; for large cattle do much hurt by poaching the ground with their feet, destroying the trenches, and spoiling the grass. Mr Boswell likewise greatly recommends a proper use of spring floods, from which he says much benefit may be derived; but, if there is any quantity of grass in the meadows not eaten, these floods must be kept out, otherwise the grass will be spoiled: for they bring with them such quantities of sand and mud, which stick to the grass, that the cattle will rather starve than taste it. Great quantities of grass or after-math are frequently spoiled in flat countries by the floods which take place in the fall. In the winter time, however, when the ground is bare, the sand and mud brought down by the floods is soon incorporated with the soil, and becomes an excellent manure. The certain rule with regard to this matter is, "Make use of the floods when the grass cannot be used; avoid them when the grass is long or soon to be cut."

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Of watering from the end of autumn to Candlemas.

"It has often been a subject of dispute (says Mr Boswell), whether, from the latter end of autumn to Candlemas, the throwing a very strong body of water, where it can be done, over the meadows, is of any essential service or not? Those who consider it as advantageous, assert, that when the waters run rude and strong over the ground, they beat down and rot the tufts of foggy or rough grass, sedges, &c. that are always to be found in many parts of coarse meadow-ground; and therefore are of peculiar service to them. On the other side it is alleged, that by coming in so large a body, it beats the ground (in the weak places particularly) so bare, that the sward is destroyed; and also brings with it such quantities of seeds of weeds, that at the next hay season the land in all those bare places bears a large burden of weeds, but little grass.

"The general opinion of the watermen upon this point is, that in water meadows which are upon a warm, sandy, or gravelly soil, with no great depth of loam upon them, rude strong watering, even in winter, alway does harm without any possible essential service. On the contrary, cold strong clay land will bear a great deal of water a long time without injury; and boggy, corky, or spongy soil, will also admit of a very large and strong body of water upon it with great advantage

Culture of Grass. for almost any length of time at that season, provided the drains are made wide and deep enough to carry it off, without forcing back upon the end of the panes. The weight and force of the water vastly assists in compressing those soils, which only want solidity and tenacity to make them produce great burdens of hay: nothing, in their opinion, corrects and improves those soils so much as a very strong body of water, kept a considerable time upon them at that season."

Notwithstanding the above reasons, however, Mr Boswell informs us, that he has doubts upon the subject; nor can he by any means acquiesce in this opinion, unless, by rude strong waters he is permitted to understand only rather a larger quantity of water conveyed over the land at this early season than ought to be used in the spring or summer: unmanageable waters he believes always hurtful.

"It may be proper just to add (continues he), that as soon as the hay is carried off the meadows, cattle of any sort except sheep may be put to eat the grass out of the trenches, and what may be left by the mowers. This perhaps will last them a week; when the water may be put into the meadows in the manner already described, taking care to mow the long grass which obstructs the water in the trenches; and this mowing is best done when the water is in them. Let the weeds, leaves, &c. be taken out and put in heaps, to be carried away into the farm yards; examine the trenches, make up the breaches, &c. take particular care that the water only dribbles over every part of the panes as thin as possible, this being the warmest season of the year. The first watering should not be suffered to last longer than two or three days before it is shifted off (and if the season be wet, perhaps not so long, as warmth seems to be the greatest requisite after the land is once wet to assist vegetation) to another part or meadow beat out by the cattle, by this time fit to take it. Do by this meadow exactly the same, and so by a third and fourth, if as many meadows belong to the occupier. Observe at all times, when the water is taken out of a meadow, to draw up the drain-slucice hatches; as, without doing that, watering is an injury. By the time that three or four parts are thus regularly watered, the first will have an after-math, with such rich and beautiful verdure as will be astonishing; and both quantity and quality will be beyond conception better than if the lands had not been watered.

"Hence we see why every person should, if possible, have three or four meadows that can be watered; for here, while the cattle are eating the first, the second is growing, the third draining, &c. and the fourth under water. In this manner the after-math will in a mild season last till Christmas. A reason was given why the spring-grass should be fed only by sheep or calves; a reason equally cogent may be given, why the after-grass ought not to be fed by them, because it will infallibly rot them. No sheep (says our author), except those which are just fat, must ever be suffered even for an hour in water meadows except in the spring of the year; and even then care must be taken that every part of the meadows have been well watered, and that they are not longer kept in them than the beginning of May. Although at present it is unknown what is the occasion of the rot, yet certain it is, that even half an hour's feeding in unhealthy ground has often proved fatal. After

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Plate XII.

a short time they begin to lose their flesh, grow weaker and weaker; the best feeding in the kingdom cannot improve them after they once fall away; and when they die, animalculæ like plaice are found in the livers. Scarcely any ever recover from a slight attack; but when farther advanced, it is always fatal. Guard by all means against keeping the water too long upon the meadow in warm weather; it will very soon produce a white substance like cream, which is prejudicial to the grass, and shows that it has been too long upon the ground already. If it be permitted to remain a little longer, a thick scum will settle upon the grass, of the consistence of glue, and as tough as leather, which will quite destroy it wherever it is suffered to be produced. The same bad effects seem to arise from rude waters; neither can the scum easily be got off.

"Rolling meadows in the spring of the year is an excellent method. It should be done after Candlemas, when the meadow has been laid dry a week. It should be always rolled lengthwise of the panes, up one side of the trench and down the other. Rolling also contributes much to the grass being cut close to the surface when mown, which is no small advantage; for the little hillocks, spewings of worms, ant-hills, &c. are by this means pressed close to the ground, which would otherwise obstruct the scythe and take off its edge; and to avoid that inconvenience, the workmen always mow over them."

As a water-meadow has with so much justice been called a *hot-bed of grass*, and as the practice of flooding tends so completely to ameliorate the poorest soils, and to extirpate heath and all coarse and woody plants, we are satisfied that the knowledge of it cannot be too extensively diffused, or too minutely inquired into. That it may be more clearly understood, therefore, we shall here give a statement of the mode in which it is practised in Gloucestershire, as explained from Mr Wright's pamphlet, by the Rev. Mr Charles Findlater, in a letter to the conductors of the Farmer's Magazine.

"Fig. 6. represents a float-meadow under irrigation; the dark shading representing the water.

"When the hatch of the water dam-dike (marked H) is lifted up, the water runs in the natural channel of the river; when the hatch is shut, as represented in the figures, the natural channel is laid dry below it, and the water runs laterally along the main-feeder, in the direction of the arrows, and is from it distributed into the floating gutters (g, g, g, g), which are formed along the crowns of the ridges, into which the meadow is arranged, overflowing on both sides of said gutters, and running down the sides of the ridges into the furrows or drains betwixt the ridges (d, d, d, d), which drains discharge it into the main drain, whereby it is returned into its natural channel at the foot of the meadow.

"The marks (o o, or Δ Δ), and the tufts, in the main-feeder and the floating gutters, denote—The first, obstructions (made by small stakes, or sods, or stones) to raise the water, and make it flow over from the main-feeder into the floating-gutters, or from the latter over the sides of the ridges; the second, nicks, made in their sides, with a similar intention. If, however, the main-feeder and floating gutters are properly constructed at their first formation, these supplementary aids will be, in a great measure, unnecessary: For the main-feeder ought, at its entrance, to be of dimensions just

sufficient to admit the quantity of water which is to be conveyed to the meadow; and gradually to contract its size as it goes along, in order that the water, for want of room, may be forced over its side, and into the floating-gutters: these last ought to be formed after the same model, that the water may, by their primary construction, overflow their sides, through their whole course. That as little as possible of the surface may be unproductive, a similar construction should be adopted for the drains; they ought to be narrow nearest to the main-feeder, where they receive little water, and to diverge as they approach the main-drain; which last is, for the same reason, similarly constructed. In the plan, this mode of construction is made obvious to the eye.

"The meadow, in this plate, must be conceived to lie in a regular and very gentle slope from the main-feeder to the main-drain.

"Fig. 4. and 5. present a view of the ridges cut across, with the feeding-gutter (g) upon their crown, and the furrows, or discharging drains (d, d) along their sides. Fig. 5. shows the shape (of gradual slope) into which they ought to be formed at first, were it not for the expence, i. e. when they are to be formed out of grass fields, preserving the grass sward. Fig. 4. represents the mode in which they may, more cheaply, though more roughly, be formed at first; when the depositions of sediment from the floating water, will gradually fill the shoulders of the floating-gutters, up to the dotted line, forming the ridge into the shape of fig. 5.

"In the formation of the meadow (particularly if the declivity is very small), care should be taken to lose as little as possible of the level in the main-feeder, and in the floating gutters; in order that the greater descent may be given to the water down the sides of the ridges, from the floating-gutters to their discharging drains, that the water may float over the ridges sides with the more rapidity, and in the more quick succession.

"The distance from the floating-gutter to the discharging-drain, ought not to be less than four yards, i. e. the breadth of the ridge eight yards; nor more than five yards and a half, i. e. the breadth of the ridge eleven yards.

"It is evident from the plan, that, when the hatch (H) is lifted up, the water resumes its natural channel, and the meadow becomes at once dry. Its figure frees it instantly of all surface water. If any of it is wet from springs, these must be carried off by under-draining: for it must be thoroughly drained before you can drown it to good effect.

"This figure represents a float-meadow, where the declivity is unequal, and which, also, is too large, for the command of water, to admit of being floated all at once.

"In this meadow, it is supposed that the ground rises, from the natural channel of the river, up to (F 1.), which is a feeder, with its floating-gutters (g, g, g, g); and thence descends to the hollow (D 1.), which is a drain communicating with the main-drain, and receiving the water from the lesser drains or receiving furrows (d, d, d). It is supposed that the ground rises again from the hollow (D 1.), up to the second feeder (F 2.); and thence descends again into the hollow, along which is conducted the receiving-drain (D 2.).

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The remainder of the meadow is supposed to lie in a regular slope, from the main-feeder to the drain last mentioned, and the main-drain. The letter (*r*) marks a very small rut, made with a spade, or triangular hoe, for conducting water to places upon which it appears not to scatter regularly.

"The hatch upon the river's natural channel, and that upon the feeder (F 2.) are represented as shut; and, consequently the natural channel, together with that part of the meadow which is floated from the feeder (F 2.), as dry. The hatches upon the feeder (F 1.), and upon the main-feeder, are represented as drawn up; and, consequently the two parts of the meadow, floated from them, are represented as under water.

Fig. 3.

"This represents catch-meadow, for a steep declivity, or side of a hill. It is called *catch*, because, when the whole is watered at once, the water floating over the uppermost pitches is caught in the floating gutters, which distribute the water over the inferior pitches.

"The lateral horizontal feeding-gutters, which scatter the water over the first and second pitches, are represented as shut by sods or stones, &c. (8); and consequently these first and second pitches appear dry: The whole water is represented as passing down the main-feeder into the lowest floating-gutter, whence it floats the lowest or third pitch; and is received into the drain at the foot of the meadow, to be returned by it into the natural channel.

"When the whole is to be floated at once, the obstructions (8) are taken from the lateral floating-gutters: obstructions, mean time, are placed in the main-feeder, immediately under the floating-gutters, to force the water into said gutters.

"N. B. In obstructing the main-feeder, care must be taken not to obstruct it entirely, but to allow always a part of the water it contains to escape in it to the lower pitches; for, supposing the main-feeder to be entirely shut under the feeding-gutter (g 1.), so that the whole water was made to run over the first pitch, from said gutter and the horizontal part of the main-drain, the water filtrated through the grass of the first-pitch, would be so very much deprived of its fertilizing qualities, as to be incapable of communicating almost any perceptible benefit to the pitches lying below. Water so filtrated, is called technically *used water*; and is esteemed next to useless; and for this reason, the grass nearest the floating-gutters is most abundant, and of best quality, in all kinds of meadow.

"The proper breadth of the pitches of catch-meadow from gutter to gutter, does not seem well determined; they ought, probably, not to be much broader than the distance from the floating-gutter to the receiving-drain in float-meadow, i. e. from four to five or six yards.—Catch-meadow is not so much prized as float-meadow.

"In the construction of the float-meadows, the floating gutters die away to nothing before they meet the main-drain; the water from the end of the gutter finding its way over the intervening space, or being assisted in scattering by small ruts marked (*r*). The receiving-drains should, for like reason, not be commenced till within half a ridge breadth of the main-feeder."

It is to be observed with regard to the last of these modes of flooding, called *catch-meadow*, that although

lands thus watered do not become equal to more level grounds subjected to the same process, or float-meadow, yet that the improvement of them is perhaps greater in proportion to the value of the lands in their original state; for, in this way, lands upon the declivity of hills, which once produced next to nothing, are enabled to bear a considerable crop of valuable grass. As streams of water are in high countries frequently found descending from very lofty situations, and as in these cases the expence of forming *catch-meadow* is very trifling, it may be regarded as of the most extensive utility.

SECT. V. Rotation of Crops.

No branch of husbandry requires more skill and sagacity than a proper rotation of crops, so as to keep the ground always in heart, and yet to draw out of it the greatest profit possible. Some plants rob the soil, others are gentle to it: some bind, others loosen. The nice point is, to intermix crops, so as to make the greatest profit consistently with keeping the ground in trim. In that view, the nature of the plants employed in husbandry must be accurately examined.

The difference between culmiferous and leguminous plants, is occasionally mentioned above. With respect to the present subject, a closer inspection is necessary. Culmiferous plants, having small leaves and few in number, depend mostly on the soil for nourishment and little on the air. During the ripening of the seed, they draw probably their whole nourishment from the soil; as the leaves by this time, being dry and withered, must have lost their power of drawing nourishment from the air. Now, as culmiferous plants are chiefly cultivated for their seed, and are not cut down till the seed be fully ripe, they may be pronounced all of them to be robbers, some more some less. But such plants, while young, are all leaves; and in that state draw most of their nourishment from the air. Hence it is, that where cut green for food to cattle, a culmiferous crop is far from being a robber. A hay-crop accordingly, even where it consists mostly of rye-grass, is not a robber, provided it be cut before the seed is formed; which at any rate it ought to be, if one would have hay in perfection. And the foggage, excluding the frost by covering the ground, keeps the roots warm. A leguminous plant, by its broad leaves, draws much of its nourishment from the air. A cabbage, which has very broad leaves, and a multitude of them, owes its growth more to the air than to the soil. One fact is certain, that a cabbage cut and hung up in a damp place, preserves its verdure longer than other plants. At the same time a seed is that part of a plant which requires the most nourishment; and for that nourishment a culmiferous plant must be indebted entirely to the soil. A leguminous crop, on the contrary, when cut green for food, must be very gentle to the ground. Pease and beans are leguminous plants; but being cultivated for seed, they seem to occupy a middle station: their seed makes them more severe than other leguminous crops cut green; their leaves, which grow till reaping, make them less severe than a culmiferous plant left to ripen.

These plants are distinguished no less remarkably by the following circumstance. All the seeds of a culmiferous plant ripen at the same time. As soon as they begin

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Culmife-
rous and le-
guminous
plants.

Rotation of Crops. begin to form, the plant becomes stationary, the leaves wither, the roots cease to push, and the plant, when cut down, is blanched and sapless. The seeds of a leguminous plant are formed successively: flowers and fruit appear at the same time in different parts of the plant. This plant accordingly is continually growing, and pushing its roots. Hence the value of bean or pease straw above that of wheat or oats: the latter is withered and dry when the crop is cut; the former green and succulent. The difference therefore, with respect to the soil, between a culmiferous and leguminous crop, is great. The latter, growing till cut down, keeps the ground in constant motion, and leaves it to the plough loose and mellow. The former gives over growing long before reaping; and the ground, by want of motion, turns compact and hard. Nor is this all. Dew falling on a culmiferous crop after the ground begins to harden, rests on the surface, and is sucked up by the next sun. Dew that falls on a leguminous crop, is shaded from the sun by the broad leaves, and sinks at leisure into the ground. The ground accordingly, after a culmiferous crop, is not only hard, but dry: after a leguminous crop, it is not only loose, but soft and unctuous.

Of all culmiferous plants, wheat is the most severe, by the long time it occupies the ground without admitting a plough. And as the grain is heavier than that of barley or oats, it probably requires more nourishment than either. It is observed above, that as pease and beans draw part of their nourishment from the air by their green leaves while allowed to stand, they draw the less from the ground; and by their constant growing they leave it in good condition for subsequent crops. In both respects they are preferable to any culmiferous crop.

Culmiferous crops, as observed above, are not robbers when cut green: the soil, far from hardening, is kept in constant motion by the pushing of the roots, and is left more tender than if it had been left at rest without any bearing crop.

Bulbous-rooted plants are above all successful in dividing and pulverizing the soil. Potato-roots grow six, eight, or ten inches under the surface; and, by their size and number, they divide and pulverize the soil better than can be done by the plough; consequently, whatever be the natural colour of the soil, it is black when a potato-crop is taken up. The potato, however, with respect to its quality of dividing the soil, must yield to a carrot or parsnip; which are large roots, and pierce often to the depth of 18 inches. The turnip, by its tap-root, divides the soil more than can be done by a fibrous-rooted plant; but as its bulbous root grows mostly above ground, it divides the soil less than the potato, the carrot, or the parsnip. Red clover, in that respect, may be put in the same class with turnip.

Whether potatoes or turnip be the more gentle crop, appears a puzzling question. The former bears seed, and probably draws more nourishment from the soil than the latter. On the other hand, potatoes divide the soil more than turnip, and leave it more loose and friable. It appears no less puzzling, to determine between cabbage and turnip: the former draws more of its nourishment from the air, the latter leaves the soil more free and open.

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†

Rotation of Crops. The result of the whole is what follows: Culmiferous plants are robbers; some more, some less: they at the same time bind the soil; some more, some less. Leguminous plants in both respects are opposite: if any of them rob the soil, it is in a very slight degree; and all of them without exception loosen the soil. A culmiferous crop, however, is generally the more profitable: but few soils can long bear the burden of such crops, unless relieved by interjected leguminous crops. These, on the other hand, without a mixture of culmiferous crops, would soon render the soil too loose.

It is scarce necessary to be mentioned, being known to every farmer, that clay answers best for wheat, moist clay for beans, loam for barley and pease, light soil for turnip, sandy soil for rye and buck-wheat; and that oats thrive better in coarse soil than any other grain. Now, in directing a rotation, it is not sufficient that a culmiferous crop be always succeeded by leguminous: attention must also be given, that no crop be introduced that is unfit for the soil. Wheat, being a great binder, requires more than any other crop a leguminous crop to follow. But every such crop is not proper: potatoes are the greatest openers of soil; but they are improper in a wheat soil. Neither will turnip answer, because it requires a light soil. A very loose soil, after a crop of rye, requires rye-grass to bind it, or the treading of cattle in pasturing: but to bind the soil, wheat must not be ventured; for it succeeds ill in loose soil.

Another consideration of moment in directing the rotation is, to avoid crops that encourage weeds. Pease is the fittest of all crops for succeeding to wheat, because it renders the grounds loose and mellow, and the same soil agrees with both. But beware of pease, unless the soil be left by the wheat perfectly free of weeds; because pease, if not an extraordinary crop, foster weeds. Barley may be ventured after wheat, if the farmer be unwilling to lose a crop. It is indeed a robber; better, however, any crop, than run the hazard of poisoning the soil with weeds. But to prevent the necessity of barley after wheat, the land ought to be fallowed before the wheat: it cleans the ground thoroughly, and makes pease a secure crop after wheat. And after a good crop of pease, barley never fails. A horse-hoed crop of turnip is equal to a fallow for rooting out weeds; but turnip does not suit land that is proper for wheat. Cabbage does well in wheat soil; and a horse-hoed crop of cabbage, which eradicates weeds, is a good preparation for wheat to be succeeded by pease; and a crop of beans, diligently hand-hoed, is in that view little inferior. As red clover requires the ground to be perfectly clean, a good crop of it ensures wheat, and next pease. In loam, a drilled crop of turnip or potatoes prepares the ground, equal to a fallow, for the same succession.

Another rule is, to avoid a frequent repetition of the same species; for to produce good crops, change of species is no less necessary than change of seed. The same species returning every second or third year, will infallibly degenerate, and be a scanty crop. This is remarkably the case of red clover. Nor will our fields bear pleasantly perpetual crops of wheat after fallow, which is the practice of some English farmers.

Hitherto of rotation in the same field. We add one rule

3 L

rule

Rotation of rule concerning rotation in different fields; which is, to avoid crowding crops one after another in point of time; but to choose such as admit intervals sufficient for leisurely dressing, which gives opportunity to manage all with the same hands, and with the same cattle; for example, beans in January or February, pease and oats in March, barley and potatoes in April, turnip in June or July, wheat and rye in October.

419
Exception-
able rota-
tions.

For illustrating the foregoing rules, a few instances of exceptionable rotations will not be thought amiss. The following is an usual rotation in Norfolk. First, wheat after red clover. Second, barley. Third, turnip. Fourth, barley with red clover. Fifth, clover cut for hay. Sixth, a second year's crop of clover, commonly pastured. Dung is given to the wheat and turnip.—Against this rotation several objections lie. Barley after wheat is improper. The two crops of barley are too near together. The second crop of clover must be very bad, if pasturing be the best way of consuming it; and if bad, it is a great encourager of weeds. But the strongest objection is, that red clover repeated so frequently in the same field cannot fail to degenerate; and of this the Norfolk farmers begin to be sensible. Salton in East Lothian is a clay soil; and the rotation there usually has been wheat after fallow and dung. Second, barley after two ploughings; the one before winter, the other immediately before the seed is sown. Third, oats. Fourth, pease. Fifth, barley. Sixth, oats; and then fallow. This rotation consists chiefly of robbing crops. Pease are the only leguminous crop, which, even with the fallow, is not sufficient to loosen a stiff soil. But the soil is good, which in some measure hides the badness of the rotation. About Seaton, and all the way from Preston to Gosford, the ground is still more severely handled: wheat after fallow and dung, barley, oats, pease, wheat, barley, oats, and then another fallow. The soil is excellent; and it ought indeed to be so, to support many rounds of such cropping.

In the parishes of Tranent, Aberlady, Dirleton, North-Berwick, and Athelstoneford, the following rotations were formerly universal, and to this day are much more frequent than any other mode.

1. After fallow and dung, wheat, barley, oats, pease and beans, barley, oats, wheat.
2. After fallow and dung, barley, oats, pease and beans, wheat, barley, oats, pease, wheat.
3. After fallow and dung, barley, oats, pease, barley, oats, wheat.
4. After fallow and dung, barley, oats, beans, wheat, pease, barley, oats.

In the several Tours that are published by Young, are found, in the best counties of England, examples without end, of rotations no less exceptionable than many of those mentioned.

420
Fields not
to be kept
too long in
pasture.

Where a field is laid down for pasture in order to be recruited, it is commonly left in that state many years; for it is the universal opinion, that the longer it lies, the richer it becomes for bearing corn. This may be true; but in order to determine the mode of cropping, the important point is, what upon the whole is the most profitable rotation; not what may produce luxuriant crops at a distant period. Upon that point it may be affirmed, that the farmer who keeps a field in pasture

beyond a certain time, loses every year considerably; and that a few luxuriant crops of corn, after 20 years of pasture, and still more after 30, will not make up the loss.

Pasture-grass, while young, maintains many animals; and the field is greatly recruited by what they drop; it is even recruited by hay crops, provided the grass be cut before seeding. But as old grass yields little profit, the field ought to be taken up for corn when the pasture begins to fail; and after a few crops, it ought to be laid down again with grass seeds. Seduced by a chimerical notion, that a field, by frequent corn crops, is fatigued, and requires rest like a labouring man or animal, careful farmers give long rest to their fields by pasture, never adverting that it affords little profit. It ought to be their study, to improve their soil, by making it free, and also retentive of moisture. If they accomplish these ends, they need not be afraid of exhausting the soil by cropping.

Where a farmer has access to no manure but what is his own production, the case under consideration, there are various rotations of crops, all of them good, though perhaps not equally so. We shall begin with two examples, one in clay and one in free soil, each of the farms 90 acres. Six acres are to be inclosed for a kitchen garden, in which there must be annually a crop of red clover, for summer food to the working cattle. As there are annually 12 acres in hay, and 12 in pasture, a single plough with good cattle will be sufficient to command the remaining 60 acres.

427
Examples
of rotation.

Rotation in a clay soil.

Inclos.	1795.	1796.	1797.	1798.	1799.	1800.
1.	Fallow.	Wheat.	Pease.	Barley.	Hay.	Oats.
2.	Wheat.	Pease.	Barley.	Hay.	Oats.	Fallow.
3.	Pease.	Barley.	Hay.	Oats.	Fallow.	Wheat.
4.	Barley.	Hay.	Oats.	Fallow.	Wheat.	Pease.
5.	Hay.	Oats.	Fallow.	Wheat.	Pease.	Barley.
6.	Oats.	Fallow.	Wheat.	Pease.	Barley.	Hay.
7.	Pasture.	Pasture.	Pasture.	Pasture.	Pasture.	Pasture.

When the rotation is completed, the seventh inclosure, having been six years in pasture, is ready to be taken up for a rotation of crops, which begins with oats in the year 1801, and proceeds as in the sixth inclosure. In the same year 1801 the fifth inclosure is made pasture, for which it is prepared by sowing pasture grass seeds with the barley of the year 1800. And in this manner may the rotation be carried on without end. Here the labour is equally distributed; and there is no hurry nor confusion. But the chief property of this rotation is, that two culmiferous or white-corn crops are never found together; by a due mixture of crops, the soil is preserved in good heart without any adventitious manure. At the same time, the land is always producing plentiful crops: neither hay nor pasture get time to degenerate. The whole dung is laid upon the fallow.

Every farm that takes a grass crop into the rotation must be inclosed, which is peculiarly necessary in a clay soil, as nothing is more hurtful to clay than poaching.

Rotation

Rotation of
Crops.Rotation of
Crops.*Rotation in a free soil.*

Incls.	1795.	1796.	1797.	1798.	1799.	1800.
1.	Turnip.	Barley.	Hay.	Oats.	Fallow.	Wheat.
2.	Barley.	Hay.	Oats.	Fallow.	Wheat.	Turnip.
3.	Hay.	Oats.	Fallow.	Wheat.	Turnip.	Barley.
4.	Oats.	Fallow.	Wheat.	Turnip.	Barley.	Hay.
5.	Fallow.	Wheat.	Turnip.	Barley.	Hay.	Oats.
6.	Wheat.	Turnip.	Barley.	Hay.	Oats.	Fallow.
7.	Pasture.	Pasture.	Pasture.	Pasture.	Pasture.	Pasture.

For the next rotation, the seventh inclosure is taken up for corn, beginning with an oat crop, and proceeding in the order of the fourth inclosure; in place of which, the third inclosure is laid down for pasture by sowing pasture grasses with the last crop in that inclosure, being barley. This rotation has all the advantages of the former. Here the dung is employed on the turnip crop.

We proceed to consider what rotation is proper for carse clay. The farm we propose consists of 73 acres. Nine are to be inclosed for a kitchen garden, affording plenty of red clover to be cut green for the farm cattle. The remaining 64 acres are divided into four inclosures, 16 acres each, to be cropped as in the following table.

Incls.	1795.	1796.	1797.	1798.
1.	Beans.	Barley.	Hay.	Oats.
2.	Barley.	Hay.	Oats.	Beans.
3.	Hay.	Oats.	Beans.	Barley.
4.	Oats.	Beans.	Barley.	Hay.

Here the dung ought to be applied to the barley.

Many other rotations may be contrived, keeping to the rules above laid down. Fallow, for example, wheat, pease and beans, barley, cabbage, oats, for clay. Here dung must be given both to the wheat and cabbage. For free soil, drilled turnip, barley, red clover, wheat upon a single furrow, drilled potatoes, oats. Both the turnip and potatoes must have dung. Another for free soil: turnip drilled and dunged, red clover, wheat on a single furrow with dung, pease, barley, potatoes, oats. The following rotation has proved successful in a soil proper for wheat. 1. Oats with red clover, after fallow without dung. 2. Hay. The clover stubble dunged, and wheat sown the end of October with a single furrow. 3. Wheat. 4. Pease. 5. Barley. Fallow again. Oats are taken the first crop, to save the dung for the wheat. Oats always thrive on a fallow, though without dung, which is not the case of barley. But barley seldom fails after pease. In strong clay soil, the following rotation answers. 1. Wheat after fallow and dung. 2. Beans sown under furrow as early as possible. Above the beans, sow pease end of March, half a boll per acre, and harrow them in. The two grains will ripen at the same time. 3. Oats or barley on a winter furrow with grass-seeds. 4. Hay for one year or two; the second growth pastured. Lay what dung can be spared on the hay-stubble, and sow wheat with a single furrow. 5. Wheat. 6. Beans or pease. 7. Oats. Fallow again.

In addition to these, we shall here state from the

Agricultural Survey of Yorkshire, an example of a rotation used in that county upon a marsh-land farm consisting of 432 acres of arable land, in which a very great number of hands and horses appear to have been employed, but in which very valuable products are reared. "The soil, where the principal part of the potatoes are grown, is a good warp; the other part on which potatoes are also cultivated, a mixture of warp and sand: the remainder of the land, clay, with a small portion of warp, but too strong to grow potatoes, except about 70 acres, which is tolerably good potato-land, but at too great a distance from the river. Grass land only sufficient to keep two milch cows, and horses necessary for working the farm: 69 acres of the best warp land divided into three equal parts; 1. fallow, with from 16 to 20 loads of manure per acre; set it with potatoes; after, sow wheat; and then fallow again: three acres of the same kind of land that is liable to be damaged by sparrows when sown with corn, is set with potatoes every year with about 10 loads of manure per acre each year: 84 acres of the lighter land is divided in the same manner, one-third fallow, with 10 loads of manure per acre; set potatoes and then sow wheat, and fallow again: 42 acres of land, lately an old pasture, divided into three parts: one-third flax, then sown with rape, and after they come off, plough and harrow the land three or four times, and lay upon it about 20 loads of manure per acre, which will make it in great condition; after which set potatoes, then sow flax again, and rape after: 150 acres divided into three parts; 1. fallow; 2. wheat; 3. beans, drilled at 9 inches distance, hand-hoed twice at 6s. per acre; fallow again, &c.: 80 acres of land that was lately in old grass, divided into four parts; fallow, wheat, beans drilled, and oats; then fallow again, &c. The remaining four acres thrown to any of the crops that are likely to fail. Rent 25s. per acre; assessments 5s. per acre.

" Distribution of crops for 1795.

	Acres.	Average Produce of an Acre.
Wheat,	-	121 from 3 to 5 quarters.
Beans,	-	70 from 3 to 6 quarters.
Oats,	-	20 from 6 to 10 quarters.
Flax,	-	14 from 45 to 55 stones.
Rape,	-	14 from 3 to 5 quarters.
Potatoes,	-	68 from 60 to 100 sacks.
Fallow,	-	121
To be thrown where a crop is likely to fail,	4	
	432	

" Servants, Horses, and Cows, kept upon the Farm.

4	House servants,
16	Labourers,
26	Horses,
2	Milch cows.

"The above is an account of a farm belonging to one of the best managers of marsh-land. We must observe he fallows his land very often; yet he is well paid by his superior crops. The last year (1795) he had 100 sacks per acre off most of his potato-land; and sold them

Reaping them from 8s. to 12s. per sack of 14 pecks. All their corn is sold by the quarter of eight Winchester bushels, though I believe their measure rather overruns." (A)

with it, the difficulty is great of getting it so dry as to be ventured in a stack. The best way is, to cut the barley with a sickle above the clover, so as that nothing but clean barley is bound up. Cut with a scythe the stubble and grass: they make excellent winter food. The same method is applicable to oats; with this only difference, that when the field is exposed to the south-west wind, it is less necessary to bind immediately after mowing. As wheat commonly grows higher than any other grain, it is difficult to manage it with the scythe; for which reason the sickle is preferred in England. Pease and beans grow so irregularly, as to make the sickle necessary.

SECT. VI. *Of Reaping Corn and Hay Crops, and Storing them up for Use.*

⁴²² Of ripeness. CULMIFEROUS plants are ripe when the stem is totally white: they are not fully ripe if any green streaks remain. Some farmers are of opinion, that wheat ought to be cut before it is fully ripe. Their reasons are, first, that ripe wheat is apt to shake; and next, that the flour is not so good. With respect to the last, it is contrary to nature, that any seed can be better in an unripe state than when brought to perfection; nor will it be found so upon trial. With respect to the first, wheat, at the point of perfection, is not more apt to shake than for some days before: the husk begins not to open till after the seed is fully ripe; and then the suffering the crop to stand becomes ticklish; after the minute of ripening, it should be cut down in an instant, if possible.

⁴²⁵ The best way for drying pease, is to keep separate the handfuls that are cut; though in this way they wet easily, they dry as soon. In the common way of heaping pease together for composing a sheaf, they wet as easily, and dry not near so soon. With respect to beans, the top of the handful last cut ought to be laid on the bottom of the former; which gives ready access to the wind. By this method pease and beans are ready for the stack in half the ordinary time.

⁴²³ Of reapers. This leads to the hands that are commonly engaged to cut down corn. In Scotland, the universal practice was, to provide a number of hands in proportion to the extent of the crop, without regard to the time of ripening. By this method, the reapers were often idle for want of work; and, what is much worse, they had often more work than they could overtake, and ripe fields were laid open to shaking winds. The Lothians have long enjoyed weekly markets for reapers, where a farmer can provide himself with the number he wants; and this practice is creeping into neighbouring shires. Where there is no opportunity of such markets, neighbouring farmers ought to agree in borrowing and lending their reapers.

⁴²⁶ A sheaf commonly is made as large as can be contained in two lengths of the corn made into a rope. To save frequent tying, the binder presses it down with his knee, and binds it so hard as totally to exclude the air. If there be any moisture in the crop, which seldom fails, a process of fermentation and putrefaction commences in the sheaf; which is perfected in the stack, to the destruction both of corn and straw. How stupid is it, to make the size of a sheaf depend on the height of the plants! By that rule, a wheat sheaf is commonly so weighty, as to be unmanageable by ordinary arms: it requires an effort to move it that frequently bursts the knot, and occasions loss of grain, beside the trouble of a second tying. Sheaves ought never to be larger than can be contained in one length of the plant, cut close to the ground; without admitting any exception, if the plants be above 18 inches high. The binder's arm can then compress the sheaf sufficiently without need of his knee. The additional hands that this way of binding may require, are not to be regarded compared with the advantage of drying soon. Corn thus managed may be ready for the stack in a week; it seldom in the ordinary way requires less than a fortnight, and frequently longer. Of a small sheaf compressed by the arm only, the air pervades every part, nor is it so apt to be unloosed as a large sheaf, however firmly bound. We omit the gathering of sheaves into shocks, because the common method is good, which is to place the shocks directed to the south-west, in order to resist the force of the wind. Five sheaves on each side make a sufficient stay; and a greater number cannot be covered with two head-sheaves.

⁴²⁴ Manner of cutting. With respect to the manner of cutting, we must premise, that barley is of all the most difficult grain to be dried for keeping. Having no husk, rain has an easy access; and it has a tendency to malten when wet. Where the ground is properly smoothed by rolling, it seems best to cut it down with the scythe. This manner being more expeditious than the sickle, removes it sooner from danger of wind; and gives a third more straw, which is a capital article for dung, where a farm is at a distance from other manure. We except only corn that has lodged; for there the sickle is more convenient than the scythe. As it ought to be dry when cut, bind it up directly: if allowed to lie any time in the swath, it is apt to be discoloured.—Barley sown with grass-seeds, red clover especially, requires a different management. Where the grass is cut along

⁴²⁷ Every article is of importance that hastens the operation in a country, like Scotland, subjected to unequal off the harvest weather; for which reason the most expeditious method should be chosen for carrying corn from the field to the stack-yard. Our carriages are generally too

(A) On this subject of rotations, it is proper to observe, that a great change has taken place since this article was written. The general rule adopted in modern husbandry is, that two grain crops ripening their seeds must never be taken in succession, a rule that is liable to few exceptions in the practice of good husbandmen. See the article AGRICULTURE in the SUPPLEMENT to this work.

Reaping and Storing up Corn and Hay. too small or too large. A sledge is a very awkward machine: many hands are required, and little progress made. Waggon and large carts are little less dilatory, as they must stand in the yard till unloaded sheaf by sheaf.

428 Of stack- ing. Building round stacks in the yard is undoubtedly preferable to housing corn. There it is shut up from the air; and it must be exceeding dry, if it contract not a mustiness, which is the first step to putrefaction. Add to this, that in the yard, a stack is preserved from rats and mice, by being set on a pedestal: whereas no method has hitherto been invented for preserving corn in a house from such destructive vermin. The proper manner of building, is to make every sheaf incline downward from its top to its bottom. Where the sheaves are laid horizontally, the stack will take in rain both above and below. The best form of a stack is that of a cone placed on a cylinder; and the top of the cone should be formed with three sheaves drawn to a point. If the upper part of the cylinder be a little wider than the under, so much the better.

429 Covering the stacks. The delaying to cover a stack for two or three weeks, though common, is, however, exceeding absurd; for if much rain fall in the interim, it is beyond the power of wind to dry the stack. Vegetation begun in the external parts, shuts out the air from the internal; and to prevent a total putrefaction, the stack must be thrown down and exposed to the air every sheaf. In order to have a stack covered the moment it is finished, straw and ropes ought to be ready; and the covering ought to be so thick as to be proof against rain.

Scotland is subject not only to floods of rain, but to high winds. Good covering guards against the former, and ropes artfully applied guard against the latter. The following is a good mode. Take a hay-ropes well twisted, and surround the stack with it, two feet or so below the top. Surround the stack with another such rope immediately below the easing. Connect these two with ropes in an up-and-down position, distant from each other at the easing about five or six feet. Then surround the stack with other circular ropes parallel to the two first mentioned, giving them a twist round every one of these that lie up and down, by which the whole will be connected together in a sort of net-work. What remains is, to finish the two feet at the top of the stack. Let it be covered with bunches of straw laid regularly up and down; the under part to be put under the circular rope first mentioned, which will keep it fast, and the upper part be bound by a small rope artfully twisted, commonly called *the crown of the stack*. This method is preferable to the common way of laying long ropes over the top of the stack, and tying them to the belting ropes; which flattens the top, and makes it take in rain. A stack covered in the way here described, will stand two years secured both against wind and rain; a notable advantage in this variable climate.

430 Hay-making. The great aim in making hay is, to preserve as much of the sap as possible. All agree in this; and yet differ widely in the means of making that aim effectual. To describe all the different means would be equally tedious and unprofitable. We shall confine ourselves to two, which appear preferable to all others. A crop of rye-grass and yellow clover ought to be spread as cut.

A day or two after, when the dew is evaporated, rake it into a number of parallel rows along the field, termed *wind-rows*, for the convenience of putting it up into small cocks. After turning the rows once and again, make small cocks weighing a stone or two. At the distance of two days or so, put two cocks into one, observing always to mix the tops and bottoms together, and to take a new place for each cock, that the least damage possible may be done to the grass. Proceed in putting two cocks into one, till sufficiently dry for tramp-ricks of 100 stone each. The easiest way of erecting tramp-ricks, is to found a rick in the middle of the row of cocks that are to compose it. The cocks may be carried to the rick by two persons joining arms together. When all the cocks are thus carried to the rick within the distance of 40 yards or so, the rest of the cocks will be more expeditiously carried to the rick, by a rope wound about them and dragged by a horse. Two ropes are sufficient to secure the ricks from wind the short time they are to stand in the field. In the year 1775, 10,000 stone were put into tramp-ricks the fourth day after cutting. In a country so wet as many parts of Scotland are, expedition is of mighty consequence in the drying both of hay and corn. With respect to hay intended for horned cattle, it is by the generality held an improvement, that it be heated a little in the stack. But we violently suspect this doctrine to have been invented for excusing indolent management. An ox, it is true, will eat such hay; but it will always be found that he prefers sweet hay; and it cannot well be doubted, but that such hay is the most salutary and the most nourishing.

The making hay consisting chiefly of red clover, 431 requires more care. The season of cutting is the last clover. week of June, when it is in full bloom; earlier it may be cut, but never later. To cut it later would indeed produce a weightier crop; but a late first cutting makes the second also late, perhaps too late for drying. At the same time, the want of weight in an early first cutting, is amply compensated by the weight of the second.

When the season is too variable for making hay of the second growth, mix straw with that growth, which will be a substantial food for cattle during winter. This is commonly done by laying strata of the straw and clover alternately in the stack. But by this method, the strata of clover, if they do not heat, turn mouldy at least, and unpalatable. The better way is, to mix them carefully with the hand before they be put into the stack. The dry straw imbibes the moisture from the clover, and prevents heating.

But the best method of hay-making seems to be that 432 recommended by Mr Anderson *. "Instead (says the Other method. he), of allowing the hay to lie, as usual in most places, for some days in the swathe after it is cut, and afterwards alternately putting it up into cocks and spreading it out, and tedding it in the sun, which tends greatly to bleach the hay, exhales its natural juices, and subjects it very much to the danger of getting rain, and thus runs a great risk of being good for little, I make it a general rule, if possible, never to cut hay but when the grass is quite dry; and then make the gatherers follow close upon the cutter, putting it up immediately into small cocks about three feet high each when new put up, and of as small a diameter as they can

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* Essays on Agriculture, vol. i. p. 186.

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and Hay.

can be made to stand with: always giving each of them a slight kind of thatching, by drawing a few handfuls of the hay from the bottom of the cock all around, and laying it lightly upon the top with one of the ends hanging downwards. This is done with the utmost ease and expedition: and when it is once in that state, I consider my hay as in a great measure out of danger: for unless a violent wind should arise immediately after the cocks are put up, so as to overturn them, nothing else can hurt the hay; as I have often experienced, that no rain, however violent, ever penetrates into these cocks but for a very little way. And, if they are dry put up, they never sit together so closely as to heat; although they acquire, in a day or two, such a degree of firmness, as to be in no danger of being overturned by wind after that time, unless it blows a hurricane.

"In these cocks I allow the hay to remain, until, upon inspection, I judge that it will keep in pretty large tramp-cocks (which is usually in one or two weeks, according as the weather is more or less favourable), when two men, each with a long pronged pitchfork, lift up one of these small cocks between them with the greatest ease, and carry them one after another to the place where the tramp-cock is to be built (1): and in this manner they proceed over the field till the whole is finished.

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Advantages of this
method.

"The advantages that attend this method of making hay, are, that it greatly abridges the labour; as it does not require above the one half of the work that is necessary in the old method of turning and tedding it: That it allows the hay to continue almost as green as when it is cut, and preserves its natural juices in the greatest perfection; for unless it be the little that is exposed to the sun and air upon the surface of the cocks, which is no more bleached than every straw of hay saved in the ordinary way, the whole is dried in the most slow and equal manner that could be desired; and, lastly, That it is thus in a great measure secured from almost the possibility of being damaged by rain. This last circumstance deserves to be much more attended to by the farmer than it usually is at present: as I have seen few who are sufficiently aware of the loss that the quality of their hay sustains by receiving a slight shower after it is cut, and before it is gathered; the generality of farmers seeming to be very well satisfied if they get in their hay without being absolutely rotted, never paying the least attention to its having been several times wetted while the hay was making. But, if these gentlemen will take the trouble at any time to compare any parcel of hay that has been made perfectly dry, with another parcel from the same field that has received a shower while in the swathe, or even a copious dew, they will soon be sensible of a very manifest difference between them; nor will their horses or

cattle ever commit a mistake in choosing between the two.

"Let it be particularly remarked, that in this manner of making hay, great care must be taken that it be dry when first put into the cocks; for if it is in the least degree wet at the time, it will turn instantly mouldy, and sit together so as to become totally impervious to the air, and will never afterwards become dry till it is spread out to the sun. For this reason, if at any time during a course of good settled weather you should begin to cut in the morning before the dew is off the grass, keep back the gatherers till the dew is evaporated; allowing that which was first cut to lie till it is dry before it is cocked. In this case, you will almost always find that the uncut grass will dry sooner than that which has been cut when wet; and therefore, the gatherers may always begin to put up that which is fresh cut before the other; which will usually require two or three hours to dry after the new-cut hay may be cocked. And if, at any time, in case of necessity, you should be obliged to cut your hay before it is dry, the same rule must be observed always to allow it to remain in the swathe till it is quite dry: but, as there is always a great risk of being long in getting it up, and as it never in this case *wins* (κ) so kindly as if it had been dry cut, the farmer ought to endeavour, if possible, in all cases to cut his hay only when dry; even if it should cost him some additional expence to the cutters, by keeping them employed at any other works, or even allowing them to remain idle, if the weather should be variable or rainy.

"But if there is a great proportion of clover, and the weather should chance to be close and calm at the time, it may, on some occasions, be necessary to open up the cocks a little to admit some fresh air into them; in which case, if they have stood a day or two, it may be of great use to turn these cocks and open them up a little, which ought to be done in the driest time of the day; the operator taking that part of each cock which was the top, and with it forming the base of a new one; so that the part which was most exposed to the air becomes excluded from it, and that which was undermost comes to be placed upon the top, so as to make it all dry as equally as possible.

"If the hay has not been damp when it was first put up, the cock may be immediately finished out at once; but if it is at all wet, it will be of great use to turn over only a little of the top of the cock at first, and leaving it in that state to dry a little, proceed to another, and a third, and fourth, &c. treating each in the same way; going in that manner till you find that the inside of the first opened cock is sufficiently dried, when it will be proper to return to it, turning over a little more of it, till you come to what is still damp, when you leave it, and proceed to another, and so on round

Reaping
and Storing
up Corn
and Hay.

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Particular
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(1) If the hay is to be carried to any considerable distance, this part of the labour may be greatly abridged, by causing the carriers to take two long sticks of a sufficient strength, and having laid them down by the small cocks parallel to one another, at the distance of one and a half or two feet asunder, let them lift three or four cocks, one after another, and place them carefully above the sticks, and then carry them altogether, as if upon a handbarrow, to the place where the large rick is to be built.

(κ) By *winning* hay, is meant the operation by which it is brought from the succulent state of grass to that of a dry fodder.

Manures. round the whole; always returning afresh till the cocks are entirely finished. This is the best way of saving your hay, if you have been under the necessity of cutting it while damp; but it is always best to guard against this inconvenience, if possible."

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Hay-stacks. In the yard, a stack of hay ought to be an oblong square, if the quantity be greater than to be easily stowed in a round stack; because a smaller surface is exposed to the air than in a number of round stacks. For the same reason, a stack of pease ought to have the same form, the straw being more valuable than that of oats, wheat, or barley. The moment a stack is finished it ought to be covered; because the surface hay is much damaged by withering in dry weather, and moistening in wet weather. Let it have a pavilion roof; for more of it can be covered with straw in that shape, than when built perpendicular at the ends. Let it be roped as directed above for corn-stacks; with this difference only, that in an oblong square the ropes must be thrown over the top, and tied to the belt-rope below. This belt-rope ought to be fixed with pins to the stack: the reason is, that the ropes thrown over the stack will bag by the sinking of the stack, and may be drawn tight by lowering the belt-rope, and fixing it in its new position with the same pins.

The stems of hops, being long and tough, make excellent ropes; and it will be a saving article, to propagate a few plants of that kind for that very end.

A stack of rye-grass hay, a year old, and of a moderate size, will weigh, each cubic yard, 11 Dutch stone. A stack of clover-hay in the same circumstances weighs somewhat less.

SECT. VII. *Manures.*

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T. Parmentier's opinions concerning manure. *Memoirs of the Royal Society of Agriculture of Paris.*
"THE use of manures (says M. Parmentier *), has been known in all ages; but we are yet far from having any clear and precise ideas of the nature of the juices which are destined for the nourishment of vegetables, and of the manner in which they are transmitted to their organs. The writers on agriculture, who have endeavoured to explain these matters, perceiving salts in most plants, were persuaded that these salts, by the help of water and heat, passed, in a saline form, through the vegetable filter. These first philosophers did not hesitate to consider every thing that has been done by the industry of man, to improve the nature of land, and its productions, as merely forming reservoirs of these salts, which they consider as the principle of fertility. This opinion was so well established among the improvers of land, that, to this day, many of them have no object in view, in their operations, but to disengage salts; and, when they attempt to explain certain phenomena which take place in their fields or orchards, they talk confidently about the *nitre of the air, of rain, of snow, of dew, and fogs; of the salts of the earth, of dung, of marl, of lime, of chalk, &c.* and make use of those vague terms, *oil, sulphur, spirit, &c.* which ought henceforward to be banished from our elementary books on agriculture.

"Among the authors who have attacked, and combated with most success the opinion that the fruitfulness of soils, and the aliment of vegetables, reside in saline substances, must be reckoned Eller and Wallerius. These philosophers examined, by every means which chemistry at that time could furnish, the various kinds

of earth proper for cultivation, and also those substances which have always been considered as the most powerful manures, without being able to obtain, from any of them, any thing more than mere atoms of salt.

"Animated with the same zeal, and taking advantage of the instructions found in their writings, I thought it necessary to determine, by experience, whether, as has been asserted, there really exist neutral salts in earths; and also, whether those earths are more fertile in proportion to the quantity of such salts they contain. With this view, I lixiviated by means of distilled water, many species of cultivated earths, taken in various states, from fresh earth to that which had been impoverished by the growth of several crops: I also tried dung, reduced more or less into the state of mould; and likewise the most active manures, such as the offal of animal substances rotted by putrefaction; but in none of these, however carefully analyzed, were found any salts in a free state. They contain indeed the materials proper for forming salts, but if they contain any ready formed, it is merely by accident.

"The researches of Kraft, and those of Alston, were not attended with different results. Having sown some oats in ashes, not lixiviated, and in sand strongly impregnated with potash and with saltpetre, and having found that the oats did not grow, they concluded that neutral salts, and alkalies, not only retarded the growth of vegetables, but that they absolutely prevented it. It is well known that in Egypt there are districts where the earth is entirely covered with sea-salt, and these districts are quite barren. It is probably owing to this property of sea-salt, that the Romans were accustomed to scatter large quantities of it over fields where any great crime had been committed, and of which they wished to perpetuate the remembrance, by rendering the part barren for a certain time.

"The idea that salts had great influence in vegetation ought to have been greatly weakened by the following simple reflection. Supposing that salts existed in garden mould, they would very soon be dissolved by the rain, and carried away, towards the lower strata of the earth, to a depth to which the longest roots would not reach. Indeed the famous experiment of Van Helmont would have been sufficient to have destroyed the above opinion, if it did not generally happen that we are no sooner set free from one error than we fall into another not less extraordinary. The surprising effects of vegetation brought about by the overflowing of water, and in the neighbourhood of salt marshes, and the infinite number of inhaling capillary tubes observed upon the surface of vegetables, led to an opinion that the air and water, absorbed by the roots and leaves of plants, were only vehicles loaded with saline matter, analogous to the vegetables nourished by them.

"To the experiment of Van Helmont, which was repeated by many accurate observers, succeeded those of modern philosophers; from which it clearly appeared, that plants could grow, and produce fruit, in the air of the atmosphere, and in distilled water, also in pure sand, in powdered glass, in wet moss or sponge, in the cavity of fleshy roots, &c. and that plants which had nothing but the above-mentioned fluids for their nourishment, gave, when submitted to chemical analysis, the same products as those which had undergone their process of vegetation in a soil perfectly well manured. It was also observed,

Manures. observed, that the most barren soils were rendered fertile when they were properly supplied with water by canals; and the efficacy of irrigation was repeatedly evinced in different ways: from these observations was formed the following system, that water rises in plants in the form of vapour, as in distillation; that air introduces itself into their pores; and that if salts contribute to the fruitfulness of soils, it is only in consequence of their containing the two fluids above mentioned in great abundance."

Our author, after making many experiments upon various soils and salts, maintains "that saline substances have no sensible effects in promoting vegetation, except inasmuch as they are of a deliquescent nature, have an earthy basis easily decomposed, and are used only in small quantity. In those circumstances they have the power of attracting, from the immense reservoir of the atmosphere, the vapours which circulate in it; these vapours they retain, along with the moisture that is produced from rain, snow, dew, fog, &c. which moisture they prevent from running together in a mass, or from being lost, either by exhaling into the air of the atmosphere, or by filtering itself through the inferior strata of the earth, and thereby leaving the roots of vegetables dry; they distribute that moisture uniformly, and transmit it, in a state of great division, to the orifices of the tubes destined to carry it into the texture of the plant, where it is afterwards to undergo the laws of assimilation. As every kind of vegetable manure possesses a viscous kind of moisture, it thereby partakes of the property of deliquescent salts. In short, the preparation of land for vegetation has no other object in view but to divide the earthy particles, to soften them, and to give them a form capable of producing the above-mentioned effects. It is sufficient, therefore, that water, by its mixture with the earth and the manure, be divided, and spread out so as to be applied only by its surface, and that it keep the root of the plant always wet, without drowning it, in order to become the essential principle of vegetation. But as plants which grow in the shade, even in the best soil, are weakly, and as the greater part of those which are made to grow in a place that is perfectly dark, neither give fruit nor flowers, it cannot be denied that the influence of the sun is of great importance in vegetable economy."

Such was the opinion of M. Parmentier while the old theory of chemistry prevailed; but when it appeared, by more recent discoveries, that air and water are not simple but compound bodies, made up of oxygen, hydrogen, and azote, and that they are resolved into these principles by many operations of nature and of art, he so far altered his theory of vegetation as to admit that air and water act their part in that process, not in a compound state, but by means of the principles of which they consist. He now concluded that the value of manured earth consists of its tendency to resolve water into gasses which give out heat while they are absorbed by the plants. As he thus supposes that the gasses constitute the food of plants, it follows, that the most aerated waters will be the most favourable to vegetation; and hence arises the value of those in which putrid animal matters are dissolved. Salts and dung act as leavens in bringing on a state of fermentation in the substances with which they are ming-

led, and operating the decomposition of water, which, along with the carbon existing in the atmosphere, he imagines contains the whole materials of the more simple vegetables. Too great a quantity of salts prevents fermentation, or the decomposition of water, and hence is prejudicial to vegetation, while a small quantity is more advantageous, as more favourable to that process of putrefaction. Different manures also give forth gasses which are absorbed by plants, and give them a peculiarity of character: hence, in a soil composed of mud and dung, cabbages acquire a bad taste, from the hepatic gas, or sulphurated hydrogen gas, which is there evolved. In addition to these chemical properties of manure, it also, by its mechanical qualities, renders the soil more permeable to water and to the roots of the plants, and is thus favourable to the progress of vegetation. At the same time, as the earths themselves have a chemical action upon water, and are capable of affording a proper basis for plants, he considers them as in many cases sufficient to promote vegetation. Upon these principles, M. Parmentier takes a view of different substances used as manures.

Marl, in his opinion, is capable of acting in the same manner as the most fertile soil, when the principles of which it is composed, namely, clay, sand, calcareous earth, and magnesian earth, are justly proportioned to each other. But it is sometimes compact and tenacious, because it contains a superabundant portion of clay, and at other times porous and friable, because it contains too much sand, and therefore is not in general fit for vegetation by itself. These considerations ought always to be our guide when we mean to employ marl as a manure.

It has been supposed that *to marl* is a sort of technical expression, intended to denote the bringing together or dividing the earthy particles by means of clay or sand. It appears to our author, that neither of the above operations can properly be called *marling*; because, in either case, all we do is, to put the soil into a situation to receive and to profit by the influence of the atmosphere, and that of the manures made use of. The peculiar principle of marl is, that part of it which, like lime, acts very powerfully upon the different aeriform fluids, is easily reduced to powder, effervesces with acids, and sends forth a quantity of air-bubbles when water is poured upon it. Now this matter, which in a particular manner does the office of manure, resides neither in clay nor in sand. Upon the proportion of it depends the duration of the fertility it produces; consequently it is of importance, when we make use of marl, to know which of its constituent parts it contains in the greatest proportion, otherwise in some cases we should only add one common kind of earth to another. Hence our author infers, that for a chalky soil clay is the proper manure, and that in such a soil a clay bottom is of more value than a gold mine.

"Wood-ashes, as a manure, may be, in some respects, compared to marl; at least they contain the same earth as those which generally enter into the composition of marl, but they contain a greater quantity of saline substances, proceeding from the vegetables of which they are the residue, and from the process made use of in their combustion; a process which increases their activity, and should render us careful in what manner and for what purpose we employ them. Wood-ashes, when

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when scattered over fields, at proper times and in proper quantities, destroy weeds, and encourage the vegetation of good plants. But do the ashes produce this effect by a sort of corrosive power? I cannot (says our author) think it; for in that case all kinds of plants would indiscriminately be acted upon by them, and to a certain degree destroyed.

"Besides, the ashes of fresh wood are seldom employed until they have been lixiviated; in which state they are deprived of their caustic principle; those ashes which are most commonly made use of for manure are produced either from wood that has been floated in water, or from turf, or from pit-coal, and contain little or no alkaline salt.

"It appears much more probable that ashes, when laid upon ground, destroy the weeds by a well known effect, namely, by seizing with eagerness that moisture which served to produce those weeds, and which in a superabundant quantity is necessary to their existence and support. Whereas those plants which have a firmer texture and a longer root, which are rendered strong by age and by having withstood the rigour of winter, and which are in fact the plants of which the fields are composed, do not suffer any damage from the application of the ashes; but, on the contrary, by being freed from the superfluous weeds which stifled them, and robbed them of a part of their sustenance, they receive a quantity of nourishment proportioned to their wants. The state of relaxation and languor to which they were reduced by a superabundance of water, leaves them, the soil gets its proper consistence, and the grass, corn, &c. acquiring the strength and vigour which are natural to them, soon overcome the moss, rushes, and other weeds; thus a good crop, of whatever the field consists of, is produced. It is in the above manner that wood ashes act, whenever in the spring it is necessary to apply them to meadows, corn fields, &c. the plants of which are stifled and weakened by a luxuriant vegetation of weeds, the usual consequence of mild and wet winters.

"When wood ashes produce an effect different from what is above described, it is either because they happen to contain too much alkaline salt, or that they are laid on the ground in too great quantity, or that the fields to which they are applied were not sufficiently wet to restrain their action; for when they are scattered upon cold soils, and buried by the plough before the time of sowing, they are, like lime, of great service. The last-mentioned substance is very efficacious in other circumstances; and there is a well known method of using it practised by the Germans, as follows: A heap of lime is formed by the side of a heap of poor earth, and water is poured upon the lime; the earth is then thrown over it, and becomes impregnated with the vapours which escape from the lime while it is slaked. The earth, after being thus aerated, may be separated; and although no lime remains mixed with it, is, by the operation just described, rendered capable of giving a luxuriant vegetation to whatever plants may be put into it.

"It is possible, therefore, to aerate earth as well as fluids; for this purpose, by mixing it with certain substances during their decomposition, we must attach to it the principles of which those substances are composed; from which there results a matter so loaded with gas, as to form a more compound substance, and one

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which has acquired new properties. The Arabians, for example, who take great pains to improve their land, are accustomed to make large pits, which they fill with animals which happen to die; these pits they afterwards cover with calcareous or clayey earth; and after some time these earths, which of themselves are sterile, acquire the properties of the richest manures.

"The foregoing observations may at least be considered as proving, that those substances which, when employed fresh and in too great quantity, are most prejudicial to vegetation, have, on the contrary, an advantageous effect, when they are previously made to undergo a fermentation; or when they are mixed with earth or water in a proportion adapted to the end proposed. The grass of fields in which cattle or poultry go to feed, after the first or second crop of hay, appears to be dried by the urine and dung of those animals, as if fire had been applied to it; whereas these same excrementitious substances, when combined with earth, or diluted with water, are capable, without any other preparation, of performing the office of good manure.

"But if animal secretions, when applied in substance to plants, were capable of acting upon them, as is affirmed, in such a way as to corrode or burn them, how could seed which has been swallowed, and escaped the action of the digestive powers, be prolific when thrown out by the animal, after having remained so long in its dung? yet we often see oats, so circumstanced, grow and produce seed. Is it not more consistent with experience and observation to suppose, that these excrementitious substances, being still endowed with animal heat, and with an organic motion, diffuse round plants in vegetation a deleterious principle or inflammable gas, which destroys them? for soon after their application, the foliage of the plant grows yellow, dries up, and the plant withers, unless there happens a shower of rain, which revives it. When these substances are diluted, by being mixed with water and earth, they lose that principle which is so destructive to vegetable life, and an incipient fermentation augments their power as a manure, so that they may be immediately made use of without any apprehension of injury from their effects.

"It appears, therefore, that any operation upon excrementitious substances, by which they are dried and reduced to powder, cannot be practised without depriving those substances of a great part of such of their principles as are easily evaporated, and upon which their fluidity depends; these principles when diluted with water, and confined by being mixed with earth, are capable of increasing the produce of the soil. Such is the way in which the husbandmen in Flanders make use of this kind of manure, in the cultivation of a kind of rape or cole seed, which is to them a very important branch of agricultural industry and commerce; and they never observe that the sap carries up any of those principles which give such manure its offensive smell; nor do they observe, that the fodder produced from fields so manured, whether eaten fresh or dry, is disagreeable to their cattle. The excrements of all animals would be injurious to plants, if applied too fresh, or in too great quantity; and a gardener could not commit a greater fault, than to put more than a certain quantity of them into the water he means to make use of to water his young plants; in short this kind of manure is to be used in a very sparing manner; and

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Manures. he that is too prodigal of it will find, to his cost, that excess, even of that which is otherwise beneficial, becomes an evil.

"It must certainly be allowed, that excrementitious substances are a very advantageous manure for cold soils, and suited to most vegetable productions; a long experience of their effects over a large tract of country, and the acknowledged intelligence of the Flemish farmers, ought to be considered as sufficient to overcome the prejudice that has been raised against this sort of manure. Supposing that the bad effects which have been attributed to it, when used in the state in which it is taken out of privies, &c. are not the offspring of a prejudiced imagination, they may have arisen from its having been made use of at an improper time, or in too great a quantity; or from its having been applied to a soil, and for the cultivation of plants, to which it was not adapted: for we know that the excess of any kind of manure changes the smell and taste of plants, and the same effect is produced by watering them too frequently. Striking examples of this change are seen in the strawberry and in the violet, when such as have grown in the woods are compared to those produced from some of our over-manured gardens; also in the lettuce, and some other plants, when those raised for sale by the gardeners about Paris are compared to those of some particular kitchen gardens. In the markets of some cities, the carrots, turnips, and potatoes of the fields, are preferred to the same kind of roots cultivated by the gardeners; for though the last are of a larger size, they have not so good a flavour. Some vegetables, therefore, are like certain wild species of the animal kingdom; they resist every kind of culture, as those animals resist every effort to tame them.

"Although experience has taught the Flemish farmers, that excrementitious substances are more active in their natural state than when dried, yet it cannot be denied that drying them, and reducing them into powder, is sometimes very advantageous, because in that state they are much less offensive, are easily transported to any distance, and may be used when most convenient or most proper. In many cities the inhabitants pay to have their privies emptied: in other places those who empty them pay for their contents; and it would astonish any one to be told how great a revenue is produced in the city of Lisle in Flanders by the sale of this kind of manure. I am, however (says our author), far from thinking that it is right, in all cases, to employ it in the above-mentioned state of concentration; it would be better, in my opinion, to follow the example of the Flemish farmers, who use it the first year for the cultivation of plants for oil, or for hemp or flax; and the second year for the best kinds of grain: thus obtaining two crops, instead of one, without any farther preparation of the land. What is said above may be applied also to the manures produced from the dung of cattle, poultry, &c. particularly to pigeons dung, the most powerful manure of its kind), all which, by being dried and powdered before they are used, lose a great portion of their activity. From these observations another fact may be deduced, namely, that manure should not be taken from the place where it has been thrown together, until the season of the year and the state of the land are such that it may be put into the ground as soon as it is brought to it. In some di-

stricts a very injurious custom prevails of carrying the manure into the fields, and leaving it there formed into small heaps, exposed for some days to the elements; during which time, either the sun and wind dry up its natural moisture, leaving a mass which is much less active; or the rain dissolves and carries away the extractive parts impregnated with the salt. This kind of brine, which is the most powerful part of the manure, penetrates the earth to a considerable depth, and shews (by the thick tufts which arise in those places, and which produce more straw than grain) that manure ought to be put into the ground as soon as it is brought to it, because it then possesses its full force and effect, and consequently would be then used to the greatest advantage.

"We have always at hand the means of composing, from a great variety of vegetable and animal substances, such manures as, when brought into a proper state, and mixed with land, contribute to its fertility. Chemistry also offers to us a number of substances, which, although when used separately they tend to diminish the fertilizing quality of the earth, are yet capable, by being combined, of forming excellent manures; such, for instance, is that saponaceous combination which is produced from a mixture of potash, oil, and earth. What an advantage it would be, if, instead of being sparing of manure, the inhabitants of the country would endeavour to increase the number of these resources, and to render them more beneficial, by employing them in a more effectual manner! How many years had passed before it was known that the refuse of apples and pears, after they are pressed (and which used to be thrown away as useless), is capable of forming as valuable a manure, in cyder and perry countries, as the refuse of grapes does in wine countries!"

From what has been observed, our author concludes, that manures act, in many circumstances, like medicines, and consequently that the same sort of manure cannot be adapted to every situation, and every kind of soil; we must therefore take care to make proper distinctions between them. Whoever shall pretend that any particular kind of manure may be used, with equal benefit, in grass land, corn fields, vineyards, orchards, kitchen gardens, &c. ought to be classed amongst those quacks who undertake to cure all persons with the same remedy, without any regard to their age, constitution, &c. It is probably from not having paid sufficient attention to the forementioned distinctions, that some authors have found fault with particular manures, while others have spoken too highly in their favour.

Having thus far stated the observations of this ingenious author, we think it necessary to remark, that the practical farmer, who wishes to advance safely and prosperously in his occupation, will probably find, that the best principle upon which he can proceed in forming his plans for the preparation of manure, will consist of keeping strictly in view the ideas which we formerly stated*, when considering the theory of agriculture. * No. 75, 76, 77, 78. When we wish to fertilize land by art, we ought to follow nature, or to imitate the process by which she fertilizes it. Vegetable substances, fermented by the putrefaction of animal matters, rapidly fall down into earth, and assume the form of that rich black mould which is the most productive of all soils. The great object of the husbandman, therefore, ought to be to procure

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rule for
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manures.

Manures. procure large quantities of vegetable substances of every kind, such as straw, stubble, rushes, weeds, &c. and to lay these up to ferment along with the fresh dung of animals, particularly those animals which chew the cud, for by digesting their food in a very perfect manner, their dung contains a large portion of animal matter. As horses, on the contrary, digest their food very weakly, their dung is often only sufficiently animalized to bring on its own fermentation, which, however, is very strong, on account of the large quantity of bits of straw, hay, and other undecomposed parts of their food which it contains. In the neighbourhood of cities, other animal substances, besides dung, may frequently be obtained; such as bullocks blood, and the refuse of works in which train oil is prepared, none of which ought to be neglected by the husbandman.

The art of fermenting vegetable by animal matters, or the true art of making dung, has not yet been brought to perfection, nor is it in almost any situation sufficiently attended to. In many places, we see large quantities of ferns, rushes, and the coarse grass of bogs, which no cattle will consume, allowed to run to waste; whereas, though these plants do not readily of themselves run into fermentation, they might easily, by proper care, be made to undergo this process, and consequently be converted into a source of riches, that is, into fertile mould. On this subject, we shall here state a mode of preparing dung upon the above principles, that has lately been discovered, and successfully adopted in Mid Lothian by the Hon. Lord Meadowbank, one of the senators of the College of Justice in Scotland. It consists of subjecting common peat-moss to the process of fermentation, now mentioned, and has been explained by his lordship in a small printed pamphlet, of which, though not sold to the public, a considerable number of copies have been distributed among his lordship's friends. It is in the following terms: "It is proper to state in the outset," says his lordship, "some general facts concerning the preparation of manure, which every practical farmer should be acquainted with.

"1. All recently dead animal or vegetable matter, sufficiently divided, moist, and not chilled nearly to freezing, tends spontaneously to undergo changes, that bring it at length to be a fat greasy earth, which when mixed with sands, clays, and a little chalk, or pounded limestone, forms what is called rich loam, or garden-mould.

438 Lord Meadowbank's mode of converting moss into manure.
 "2. In vegetable matter, when amassed in quantities, these changes are at first attended with very considerable heat, (sometimes proceeding the length of inflammation), which, when not exceeding blood-heat, greatly favours and quickens the changes, both in animal matter, and the further changes in vegetable matter, that are not sensibly attended with the production of heat. The changes attended with heat, are said to happen by a fermentation, named from what is observed in making of ale, wine, or vinegar. The latter are ascribed to what is called *putrefactive fermentation*.

"3. Besides moderate moisture and heat, and that division of parts which admits the air in a certain degree, circumstances which seem to be necessary to the

production of these changes, stirring, or mechanical mixture, favours them; and a similar effect arises from the addition of chalk, pounded limestone, lime, rubbish of old buildings, or burnt lime brought back to its natural state; and also of ashes of burnt coal, peat, or wood, soap-leys, soot, sea-shells, and sea-ware. And, on the other hand, the changes are stopped or retarded by pressure or consolidation, excluding air; by much water, especially when below the heat of a pool in summer; by astringents; and by caustic substances, as quicklime, acids, and pure alkalies, at least till their causticity is mollified, at the expence of the destruction of part of the animal and vegetable matter to which they are added.

"4. These changes are accomplished by the separation or decomposition of the parts or ingredients of which the dead vegetables and animals are composed; by the escape of somewhat of their substance in the form of vapours or gasses; by the imbibing also somewhat from water and from the atmosphere; and by the formation of compound matters, from the reunion of parts or ingredients, which had been separated by the powers of the living vegetables and animals. The earlier changes, and in general those which take place previous to the destruction of the adhesion and texture of the dead vegetables and animals, appear to be rather pernicious than favourable to the growth of living vegetables, exposed to the direct effect of them; whereas the changes subsequent to the destruction of the animal and vegetable texture promote powerfully the growth of plants, and, partly by their immediate efficacy on the plants exposed to their influence, partly by the alterations they produce in the soil, constitute what is to be considered as enriching manure (L).

"5. It should be the object of the farmer to give his soil the full benefit of these latter changes, decompositions, and recompositions, which proceed slowly, and continue to go on for years after the manure is lodged in the soil. Even loam or garden-mould is still undergoing some remaining changes of the same sort; and, by frequently stirring it, or removing it, and using it as a top-dressing, its spontaneous changes are so favoured, that it will yield heavy crops for a time, without fresh manure; or, in other words, it is rendered in so far a manure itself, as it decomposes faster than in its ordinary and more stationary state, and in so doing, nourishes vegetables more abundantly, or forms new combinations in the adjoining soil, that enable it to do so.

"It should also be the object of the farmer, to employ the more early changes, not only to bring forward the substances undergoing them into a proper state to be committed to the soil, but to accelerate or retard them, so as to have his manure ready for use at the proper seasons, with as little loss as possible, from part being too much and part too little decomposed; and also to avail himself of the activity of those changes, to restore to a state of sufficiently rapid spontaneous decomposition, such substances in his farm, as, though in a state of decay, had become so stationary, as to be unfit for manure, without the aid of heat and mixture.

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(L) Hot fermenting dung partakes of both sorts of fermentation.

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"By attention to the two first particulars, and the proper use of compression, stirring, and mixture, the farm dunghill, though formed slowly and of materials in very various states of decay, is brought forward in nearly the same condition. By attention to the latter, manure may, in most situations in Scotland, be tripled or quadrupled; *et finum est aurum*. On the other hand, by inattention to them, part of the manure is put into the soil unprepared, that is, in a situation where the texture of the vegetable is still entire; and, its decomposition never having been carried far by the heat and mixture of a fermenting mass, proceeds in the soil so slowly, that, like ploughed-down stubble, it does not merit the name of manure. Part, again, is apt to be too much rotted, that is, much of it is too nearly approaching to the state of garden-mould, whereby much benefit is lost, by the escape of what had been separated during the process it has undergone, and the good effects on the soil of what remains are less durable; for, between solution in water and rapid decomposition from its advanced state of rottenness, it is soon reduced to that of garden-mould; and, in fine, the powers of fermenting vegetable with animal matter, which, when properly employed, are certainly most efficacious in converting into manure many substances that are otherwise very stationary and slow in their decomposition, are lost to the farmer, so that he is often reduced to adopt an imperfect and little profitable mode of cultivation, from the want of the manure requisite for a better, though such manure may be lying in abundance within his reach, but useless from his ignorance how to prepare it.

"*Peat-moss* is to be found in considerable quantities within reach of most farms in Scotland, particularly in those districts where outfield land (i. e. land not brought into a regular course of cropping and manuring) forms the larger part of the arable land. It consists of the remains of shrubs, trees, heath, and other vegetables, which, under the influence of a cold and moist climate, and in wet situations, have got into a condition almost stationary, but much removed from that of the recently dead vegetable, and certainly considerably distant from that of garden mould. It is no longer susceptible of going of itself, though placed in the most favourable circumstances, into that rapid fermentation, accompanied with heat, which masses of fresh vegetables experience: But it is still a powerful fuel when dried; and, on the other hand, it requires long exposure to the seasons, in a dry situation, before, without mixture, it is fit for the nourishing of living vegetables.

"In general, however, there is nothing in the situation of peat moss, or in the changes it has undergone, that leads to think that it has suffered any thing that unfits it to be prepared for manure. It is no doubt found sometimes mixed with particular mineral substances, that may be, for a time, pernicious to vegetation; but, in general, there is no such admixture, and, when it does take place, a little patience and attention will be sufficient to cure the evil. In the ordinary

case, the only substances found in peat that may be unfavourable to vegetation, in so far at least as tending to keep it stationary, and prevent its rotting, are two, and both abounding in fresh vegetables of the sorts of which moss is chiefly composed: These are, gallic acid, and the astringent principle, or tan; and, as these are got the better of in fresh vegetables by the hot fermentation to which they are subject, so as to leave the general mass of the substances to which they belonged properly prepared manure, there is no reason to suppose that the same may not be accomplished with the acid and tan of peat. Again, the powers of peat as a fuel, and of ashes of peat as a manure, ought to convince every person, that the material and more essential parts of the dead vegetable, for the formation of manure, remain entire in peat. Here the inflammable oils and carbonaceous matter which abound in the fresh vegetable, and the latter of which also abounds in garden-mould, remain entire; the soot and ashes, too, which are the results of the inflammation of each, seem to be nearly equally fertilizing; and, in short, little seems to be lost in peat but the effects of the first fermentation in preparing the matter to undergo its future changes with the rapidity requisite to constitute manure. Besides, the soil produced from peat-earth, by exposure for a course of years, seems not to be sensibly different from that obtained from dung in the same way. Both are deficient in firmness of texture; but are very prolific when mixed with clays, sands, and calcareous earths, in due proportion.

"From considering the preceding circumstances, and from trying what substances operated on tan, and on the acid found in peat-moss, it was determined to subject it to the influence of different sorts of fermenting dung, with due attention to the proportions used, and to the effects of the different preparations; and the following is the direction, which an experience of six crops recommends to practice.

"Let the peat moss, of which compost is to be formed, be thrown out of the pit for some weeks or months, in order to lose its redundant moisture. By this means, it is rendered the lighter to carry, and less compact and weighty, when made up with fresh dung, for fermentation; and accordingly less dung is required for the purpose, than if the preparation is made with peat taken recently from the pit.

"Take the peat-moss to a dry spot, convenient for constructing a dunghill, to serve the field to be manured. Lay it in two rows, and dung in a row betwixt them. The dung thus lies on the area of the compost-dunghill, and the rows of peat should be near enough each other, that workmen in making up the compost, may be able to throw them together by the spade, without wheeling. In making up, let the workmen begin at one end. Lay a bottom of peat, 6 inches deep, and 15 feet wide, if the ground admit of it (M). Then lay about 10 inches of dung above the peat; then about 6 inches of peat; then four or five of dung, and then six more of peat; then another thin layer of dung; and then cover it over with peats at the end where it was begun,

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(M) This alludes to the propriety, in clay lands, of suiting the dunghill to the breadth of a single ridge, free of each furrow.

Manures.

Manures. at the two sides, and above. It should not be raised above 4 feet, or $4\frac{1}{2}$ feet high, otherwise it is apt to press too heavily on the under part, and check the fermentation. When a beginning is thus made, the workmen will proceed working backwards, and adding to the column of compost, as they are furnished with the three rows of materials, directed to be laid down for them. They must take care not to tread on the compost, or render it too compact; and, of consequence, in proportion as the peat is wet, it should be made up in lumps, and not much broken.

"In mild weather, seven cart-load of common farm-dung, tolerably fresh made, is sufficient for 21 cart-loads of peat-moss: but in cold weather, a larger proportion of dung is desirable. To every 28 carts of the compost, when made up, it is of use to throw on above it a cart-load of ashes, either made from coal, peat, or wood; or if these cannot be had, half the quantity of slaked lime may be used, the more finely powdered the better. But these additions are nowise essential to the general success of the compost.

"The dung to be used should either have been recently made, or kept fresh by compression; as, by the treading of cattle or swine, or by carts passing over it. And if there is little or no litter in it, a smaller quantity will serve, provided any spongy vegetable matter is added at making up the compost, as fresh weeds, the rubbish of a stack-yard, potato-shaws, sawings of timber, &c. And as some sorts of dung, even when fresh, are much more advanced in decomposition than others, it is material to attend to this; for a much less proportion of such dung, as is less advanced, will serve for the compost, provided care is taken to keep the mass sufficiently open, either by a mixture of the above-mentioned substances, or, if these are wanting, by adding the moss piece-meal, that is, first mixing it up in the usual proportion of three to one of dung, and then, after a time, adding an equal quantity, more or less, of moss. The dung of this character, of greatest quantity, is shamble-dung, with which, under the above precautions six times the quantity of moss, or more, may be prepared. The same holds as to pigeon-dung, and other fowl-dung; and to a certain extent, also, as to that which is collected from towns, and made by animals that feed on grains, refuse of distilleries, &c.

"The compost, after it is made up, gets into a general heat, sooner or later, according to the weather, and the condition of the dung: in summer, in ten days or sooner; in winter, not perhaps for many weeks, if the cold is severe. It always, however, has been found to come on at last; and in summer, it sometimes rises so high, as to be mischievous, by consuming the materials, (fire-fanging). In that season, a stick should be kept in it in different parts, to pull out and feel now and then: for if it approaches to blood-heat, it should either be watered, or turned over; and on such an oc-

Manures. cation, advantage may be taken to mix it with a little fresh moss. The heat subsides after a time, and with great variety according to the weather, the dung, and the perfection of the making up of the compost; which then should be allowed to remain untouched, till within three weeks of using, when it should be turned over, upside down, and outside in, and all lumps broken: then it comes into a second heat; but soon cools, and should be taken out for use. In this state, the whole, except bits of the old decayed wood, appears a black free mass, and spreads like garden-mould. Use it, weight for weight, as farm-yard dung; and it will be found, in a course of cropping, fully to stand the comparison.

"The addition recommended of ashes or lime, is thought to favour the general perfection of the preparation, and to hasten the second heat. The lime laid on above the dunghill, as directed, is rendered mild by the vapours that escape during the first heat.

"Compost, made up before January, has hitherto been in good order for the spring-crops; but this may not happen in a long frost. In summer, it is ready in eight or ten weeks; and if there is an anxiety to have it soon prepared, the addition of ashes, or of a little lime-rubbish of old buildings, or of lime slaked with foul water, applied to the dung used in making up, will quicken the process considerably.

"Lime has been mixed previously with the peat; but the compost prepared with that mixture, or with the simple peat, seemed to produce equally good crops. All the land, however, that it has been tried on, has been limed more or less within these 25 years.

"Peat prepared with lime alone, has not been found to answer as a good manure. In one instance, viz. on a bit of fallow sown with wheat, it was manifestly pernicious. Neither with cow-water alone is it prepared, unless by lying immersed in a pool of it for a long time, when it turns into a sort of sleetch, which makes an excellent top-dressing. Something of the same sort happens with soap-suds, and water of common sewers, &c. Lime-water was not found to unite with the tan in peat, nor was urine (N). Peat made up with seaweeds gets into heat, and the peat seems to undergo the same change as when prepared with dung. But the effect of this preparation on crops has not yet been experienced. Peat has also been exposed to the fumes of a putrefying carcase. In one instance the peat proved a manure; but much weaker than when prepared with dung. There, however, the proportion used was very large to the carcase. Other trials are making, where the proportion is less, and with, or without, the addition of ashes, lime, &c. In all these cases, there can be no sensible heat. Peat, heated and rendered friable by the action of the living principle of turnips in growing, was not found entitled, when used as a top-dressing, to the character of manure. It had been made up in the view of preserving the turnips during frost.

(N) Tan combines with animal gelly, and loses its astringency. The animalized matter, extricated in fermenting dung, has probably this effect on the tan in peat, as well as to render the acid innocent. As vegetable matters seem in general to contain the ingredients of, and often somewhat similar to, animal gluten, it is possible that the fermentation of fresh vegetables alone may prove sufficient to prepare the peat to rot in the soil expeditiously; but it is certainly desirable to use also animalized matter for this purpose.

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frost. But the turnips sprung, and the mass heated. The turnips were taken out and the peat afterwards used as a top-dressing. Peat is now under trial, as preparing with turnips and fresh weeds, in fermentation, without the admixture of any animalized matters.

"It is said that dry peat-earth is used as a manure in some parts of England. But unless in chalky soils, or others where there may be a great want of carbonaceous matter, it is much doubted whether it could be used with any sensible advantage. Peat-ashes were found to raise turnips, but to have no sensible effect on the next crop.

"The quantity of the compost used per acre, has varied considerably, according to the richness of the soil manured, and the condition in which it is at manuring, and the season in which the manure is applied. From 23 to 35 cart-load, by two horses each, is about what has been given; the lesser to fallows and ground in good tilth, and the larger when to be ploughed in with the sward of poor land; and the intermediate quantities, with tares, pease, potatoes, &c.; and it has in most cases undergone comparative trials with different sorts of common dung.

"It may be proper to add, that too much attention cannot be paid to the proper preparation of the ground for the reception of manure. It should be clean, pretty dry at the application, and well mixed and friable. Much of the manure applied is otherwise lost, whether lime, dung, or compost. The additional quantities recommended when the land is coarse, is just so much that would have been saved by better cultivation. Common farmers are little aware of this. They might save at least half their lime, did they lay it on in powder (o), and on fallows, only harrowing it, and letting it wait for a shower before it is ploughed in; and perhaps not much less of their dung. It is astonishing what a visible effect is produced on land properly mixed by a fallow, from the addition of only a very small quantity of properly prepared dung or compost. Both its texture and colour undergo a very sensible change, which cannot be accounted for, except from the extrication of substances from the decomposing manure, (probably from its spontaneous tendency to decompose being aided by the chemical action of various matters in a soil so prepared): And from these substances operating in the soil, numberless compositions and decompositions, or tendencies to them, take place, from the various elective attractions of the different parts of which it is composed. It is obvious, that an immensely greater proportion of manure must be required to produce even a little of this, where the soil is coarse or lumpy, or consolidated by wetness, than when put into a situation favourable to the reciprocal action of the various substances contained in it, a variety and an admixture formed by nature in perfection in the more favoured soils, (as in the bottom of drained lakes, haughs, Delta ground), and which it is the business of the skillful and industrious farmer to form or make compensation for the want of, by judicious manuring, where nature has been less bountiful of her gifts.

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"It was meant to have given a detailed account of many of the experiments that have been made, whether in Agriculture or Chemistry. But as these are still going on, and the practical results have attracted some attention, and prompted imitation by neighbours and acquaintance, so that manuscript directions have been often applied for and obtained, it has been preferred to print, in the mean time, this short account of the business, divested of scientific language, and suited to the perusal of any practical husbandman. It was indeed felt as a degree of wrong, not to take some steps to make it public, as soon as the certainty of success warranted. And both the power and the duration of the manure have now stood the test of a great variety of trials on a considerable extent of ground, and of much diversity of soil, continued without intermission during the last six years. Hitherto it has been found equal, and even preferable, to common farm-yard dung, for the first three years, and decidedly to surpass it afterwards. It has been conjectured, from the appearance and effects of the compost, that its parts are less volatile and soluble than those of dung; but that it yields to the crop what is requisite, by the action of the living fibres of vegetables; and in this way wastes slower, and lasts longer. Whatever be in this, nothing has appeared more remarkable, than its superiority in maintaining (for four and five years) fresh and nourishing the pasture of thin clays, that had been laid down with it, and in making them yield well when again ploughed, and that without any top dressing, or new manure of any sort. Employed in this way, the effect of common dung is soon over, the soil becoming consolidated, and the pasture stunted; and hence such soils have not usually been cultivated with advantage, except by tillage, and by the aid of quantities of manure, got by purchase, and much beyond the produce of the farm-yard. It is believed that the foregoing directions will, if practised, prove beneficial to every farmer who has access to peat-moss within a moderate distance; but it is to the farmers of the soils now mentioned, and of hungry gravels, to whom they would be found particularly valuable.

"Let it be observed, that the object in making up the compost is to form as large a hot-bed as the quantity of dung employed admits of, and then to surround it on all sides so as to have the whole benefit of the heat and effluvia. Peat, as dry as garden-mould, in seed-time, may be mixed with the dung, so as to double the volume and more, and nearly triple the weight, and instead of hurting the heat prolong it. Workmen must begin with using layers; but, when accustomed to the just proportions, if they are furnished with peat moderately dry, and dung not lost in litter, they throw it up together as a mixed mass; and they improve in the art, so as to make a less proportion of dung serve for the preparation."

With regard to the other kinds of manure commonly used in this country, their efficacy is well known; the only difficulty is to procure them in sufficient quantity.—

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Of the more common kinds of manure.

(o) This they may, though driven in winter, and drowned in the heaps by rains. They have only to turn it over with a very small additional quantity of new burnt shells when they come to use it.

Manures. tity.—In such lands as lie near the sea, sea-weeds offer an unlimited quantity of excellent manure. In the neighbourhood of rivers, the weeds with which they abound offer likewise an excellent manure in plenty. Oil-cake, malt-combs, the refuse of slaughter-houses, &c. all are excellent where they can be got: but the situations which afford these are comparatively few; so that in most cases the farmer must depend much on his own ingenuity and industry for raising a sufficient quantity of dung to answer his purposes: and the methods taken for this purpose vary according to the situation of different places, or according to the fancy of the husbandman.

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Manures
sed in
Norfolk.

In all countries where chalk, marl, or lime, are to be had, they are certainly to be employed in their proper departments; but besides these, *dung*, properly so called, mixed with earth or putrid animal and vegetable substances, every where constitutes a principal part of the manure. In Norfolk, Mr Marshall tells us, that the *quality* of dung is attended to with greater precision than in most other districts. *Town-muck*, as it is called, is held in most estimation; and the large towns Norwich and Yarmouth supply the neighbouring country. As Yarmouth, however, is a maritime place, and otherwise in a manner surrounded by marshes, straw is of course a scarce and dear article; whence, instead of littering their horses with it, they use sand. As the bed becomes soiled or wet, fresh sand is put on, until the whole is in a manner saturated with urine and dung, when it is cleared away, and reckoned muck of such excellent quality, that it is sent for from a very great distance. With regard to other kinds of dung, that from horses fed upon hay and corn is looked upon to be the best; that of fatting cattle the next; while the dung of lean cattle, particularly of cows, is supposed to be greatly inferior, even though turnips make part of their food. The dung of cattle kept on straw alone is looked upon to be of little or no value; while the muck from trodden straw is by some thought to be better than that from the straw which is eaten by the lean stock.—Composts of dung with marl or earth are very generally used.

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In the midland counties of England, Mr Marshall informs us, the cores of horns crushed in a mill have been used as a manure; though he knows not with what success. His only objection is the difficulty of reducing them to powder. Dung is extremely dear in Norfolk; half a guinea being commonly given for a waggon-load driven by five horses. Great quantities of lime and marl are found in this district. With regard to the method of raising dung in general, perhaps the observations of Mr Marshall upon the management of the Yorkshire farmers may be equally satisfactory with any thing that has yet been published on the subject.

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“The general practice (says he) is to pile the dung on the highest part of the yard; or, which is still less judicious, to let it lie scattered about on the side of a slope, as it were for the purpose of dissipating its virtues. The urine which does not mix with the dung is almost invariably led off the nearest way to the common sewer, as if it were thought a nuisance to the premises. That which mixes with the dung is of course carried to the *midden*, and assists in the general dissipation. A yard of *dung*, nine-tenths of which are straw, will discharge, even in dry weather, some of its more

fluid particles; and in rainy weather is, notwithstanding the straw, liable to be washed away if exposed on a rising ground. But how much more liable to waste is a mixture of dung and urine, with barely a sufficiency of straw to keep them together! In dry weather the natural oozing is considerable; and in a wet season every shower of rain washes it away in quantities. The Norfolk method of bottoming the dung-yard with mould is here indispensably necessary to common good management. There is no better manure for grass-lands than mould saturated with the oozing of a dunghill: it gets down quickly among the grass, and has generally a more visible effect than the dung itself. Under this management the arable land would have the self-same dung it now has; while the grass-land would have an annual supply of riches, which now run to waste in the sewers and rivulets. But before a dung-yard can with propriety be bottomed with mould, the bottom of the yard itself ought to be properly formed. A part of it situated conveniently for carriages to come at, and low enough to receive the entire drainings of the stable, cattle-stalls, and hog-sties, should be hollowed out in the manner of an artificial drinking-pool, with a rim somewhat rising, and with covered drains laid into it from the various sources of liquid manure. During the summer months, at leisure times, and embracing opportunities of back-carriage, fill the hollow nearly full with mould, such as the scourings of ditches, the shovellings of roads, the maiden earth of lanes and waste corners, the coping of stone-quarries, &c. &c. leaving the surface somewhat dished; and within this dish set the dung-pile, carefully keeping up a rim of mould round the base of the pile higher than the adjoining surface of the yard; equally to prevent extraneous matter from finding its way into the reservoirs, and to prevent the escape of that which falls within its circuit.”

The use of lime as a manure, was formerly mentioned*, and also the principle upon which its value depends. It ought to be used not for the purpose of giving food to the plants, but as a stimulant, tending to bring the soil into activity, by reducing to mould all the dead roots of vegetables with which it may abound. Hence it ought never to be used without dung upon soils that have been exhausted by repeated cropping, and that are in a clean state.

However people may differ in other particulars, all agree, that the operation of lime depends on its intentions. mate mixture with the soil; and therefore that the proper time of applying it, is when it is perfectly powdered, and the soil at the same time in the highest degree of pulverization. Lime of itself is absolutely barren; and yet it enriches a barren soil. Neither of the two produces any good effect without the other; and consequently, the more intimately they are mixed, the effect must be the greater.

Hence it follows, that lime ought always to be slaked with a proper quantity of water, because by that means it is reduced the most effectually into powder. Lime left to be slaked by a moist air, or accidental rain, is seldom or never thoroughly reduced into powder, and therefore can never be intimately mixed with the soil. Sometimes an opportunity offers to bring home shell-lime before the ground is ready for it; and it is commonly thrown into a heap without cover, trusting to

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Of lime as
a manure.
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^{Manures.} to rain for slaking. The proper way is, to lay the shell-lime in different heaps on the ground where it is to be spread, to reduce these heaps into powder by slaking with water, and to cover the slaked lime with sod, so as to defend it from rain. One, however, should avoid as much as possible the bringing home lime before the ground be ready for it. Where allowed to lie long in a heap, there are two bad consequences: first, lime attracts moisture, even though well covered, and runs into clots, which prevents an intimate mixture; and, next, we know that burnt limestone, whether in shells or in powder, returns gradually into its original state of limestone; and upon that account also, is less capable of being mixed with the soil. And this is verified by a fact, that, after lying long, it is so hard bound together as to require a pick to separate the parts.

For the same reason, it is a bad practice, though common, to let spread lime lie on the surface all winter. The bad effects above mentioned take place here in part: and there is another, that rain washes the lime down to the furrows, and in a hanging field carries the whole away.

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Time of
liming.

As the particles of powdered lime are both small and heavy, they quickly sink to the bottom of the furrow, if care be not taken to prevent it. In that view, it is a rule, that lime be spread and mixed with the soil immediately before sowing, or along with the seed. In this manner of application, there being no occasion to move it till the ground be stirred for a new crop, it has time to incorporate with the soil, and does not readily separate from it. Thus, if turnip-seed is to be sown broad-cast, the lime ought to be laid on immediately before sowing, and harrowed in with the seed. If a crop of drilled turnip or cabbage be intended, the lime ought to be spread immediately before forming in drills. With respect to wheat, the lime ought to be spread immediately before seed-furrowing. If spread more early, before the ground be sufficiently broken, it sinks to the bottom. If a light soil be prepared for barley, the lime ought to be spread after seed-furrowing, and harrowed in with the seed. In a strong soil, it sinks not so readily to the bottom, and therefore, before sowing the barley, the lime ought to be mixed with the soil by a brake. Where moor is summer-fallowed for a crop of oats next year, the lime ought to be laid on immediately before the last ploughing, and braked in as before. It has sufficient time to incorporate with the soil before the land be stirred again.

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Quantity.

The quantity to be laid on depends on the nature of the soil. Upon a strong soil, 70 or 80 bolls of shells are not more than sufficient, reckoning four small firlots to the boll, termed *wheat measure*; nor will it be an overdose to lay on 100 bolls. Between 50 and 60 may suffice upon medium soils; and upon the thin or gravelly, between 39 and 40. It is not safe to lay a much greater quantity on such soils.

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Liming pas-
ture-fields.

It is common to lime a pasture-field immediately before ploughing. This is an unsafe practice; it is thrown to the bottom of the furrow, from which it is never fully gathered up. The proper time for liming a pasture field, intended to be taken up for corn, is a year at least, or two, before ploughing. It is washed

in by rain along the roots of the plants, and has time to incorporate with the soil. ^{Manures.}

Limestone beat small makes an excellent manure; and supplies the want of powdered lime where there is no fuel to burn the limestone. Limestone beat small has not hitherto been much used as a manure; and the proportion between it and powdered lime has not been ascertained. What follows may give some light. Three pounds of raw lime is by burning reduced to two pounds of shell-lime. Yet nothing is expelled by the fire but the air that was in the limestone: the calcareous earth remains entire. *Ergo*, two pounds of shell-lime contains much calcareous earth as three pounds of raw limestone. Shell-lime of the best quality, when slaked with water, will measure out to thrice the quantity. But as limestone loses none of its bulk by being burnt into shells, it follows that three bushels of raw limestone contain as much calcareous earth as six bushels of powdered lime; and consequently, if powdered lime possess not some virtue above raw limestone, three bushels of the latter beat small should equal as a manure six bushels of the former.

Shell-marl as a manure is managed in every respect like powdered lime; with this only difference, that a marl like powdered lime with more in measure ought to be given. The reason is, that shell-marl is less weighty than lime; and that a boll of it contains less calcareous earth, which is the fructifying part of both. ⁴⁴⁸ Of shell-marl.

Clay and stone marls, with respect to husbandry, are the same, though in appearance different. ⁴⁵⁰ Of clay and stone marls.

The goodness of marl depends on the quantity of calcareous earth in it: which has been known to amount to a half an acre. It is too expensive if the quantity be less than a third or a fourth part. Good marl is the most substantial of all manures; because it improves the weakest ground to equal the best borough-acres. The low part of Berwickshire, termed *the Merse*, abounds everywhere with this marl; and is the only county in Scotland where it is plenty.

Land ought to be cleared of weeds before marling; and it ought to be smoothed with the brake and harrow, in order that the marl may be equally spread. Marl is a soil on which no vegetable will grow; its efficacy depends, like that of lime, on its pulverization, and intimate mixture with the soil. Toward the former, alternate drought and moisture contribute greatly, as also frost. Therefore, after being evenly spread, it ought to lie on the surface all winter. In the month of October it may be roused with a brake; which will bring to the surface, and expose to the air and frost, all the hard parts, and mix with the soil all that is powdered. In that respect it differs widely from dung and lime, which ought usually to be ploughed into the ground without delay. Oats is a hardy grain, which will answer for being the first crop after marling better than any other, and it will succeed though the marl be not thoroughly mixed with the soil. In that case, the marl ought to be ploughed in with an ebb furrow immediately before sowing, and braked thoroughly. It is ticklish to make wheat the first crop: if sown before winter, frost swells the marl, and is apt to throw the seed out of the ground; if sown in spring, it will suffer more than oats by want of due mixture.

Summer is the proper season for marling; because in that

^{Manures.} that season the marl, being dry, is not only lighter, but is easily reduced to powder. Frost, however, is not improper for marling, especially as in frost there is little opportunity for any other work.

Marl is a heavy body, and sinks to the bottom of the furrow, if indiscreetly ploughed. Therefore the first crop should always have an ebb furrow. During the growing of that crop, the marl has time to incorporate with the soil, and to become a part of it; after which it does not readily separate.

⁴⁵¹
Of gypsum
as a ma-
nure.

Of late a new manure has been introduced into some countries. This is gypsum, which is lime united with sulphuric acid. In the eighth volume of the Annals of Agriculture we are informed, that it is commonly used as a manure in Switzerland. In the 10th volume of the same work, Sir Richard Sutton gives some account of an experiment made with it on his estate; but in such an inaccurate manner, that nothing could be determined. "The appearance in general (says he), I think, was rather against the benefit of the plaster, though not decidedly so." He tells us, that its virtues were a subject of debate in Germany. In America this substance seems to have met with more success than in any other country. In the fifth volume of Bath Papers, Mr Kirkpatrick of the isle of Wight, who had himself visited North America, informs us, that it is much used in the United States, on account of its cheapness and efficacy; though, from what is there stated, we must undoubtedly be led to suppose, that its efficacy must be very great before it can be entitled to the praise of *cheapness*. In the first place, it is brought from the hills in the neighbourhood of Paris to Havre de Grace, and from thence exported to America; which of itself must occasion a considerable expence, though the plaster were originally given *gratis*. In the next place it must be powdered in a stamping mill, and the finer it is powdered so much the better. In the third place, it must be sown over the ground to be manured with it. The quantity for grass is six bushels to an acre. It ought to be sown on dry ground in a wet day; and its efficacy is said to last from seven to twelve years. It operates entirely as a top-dressing.

In the 10th volume of the Annals of Agriculture, we have some extracts from a treatise by Mr Powel, president of the Philadelphia Society for encouraging Agriculture, upon the subject of gypsum as a manure; of the efficacy of which he gives the following instances. 1. In October 1786, plaster of Paris was sown in a rainy day upon wheat stubble without any previous culture. The crop of wheat had scarce been worth reaping, and no kind of grass seed had been sown upon the ground; nevertheless, in the month of June it was covered with a thick mat of white clover, clean and even, from six to eight inches in height. A piece of ground adjoining to this white clover was also sown with gypsum, and exhibited a fine appearance of white and red clover mixed with spear-grass. Some wet ground sown at the same time was not in the least improved.—This anecdote rests entirely on the veracity of an anonymous farmer. 2. Eight bushels of plaster of Paris spread upon two acres and a half of wheat stubble ground, which the spring before had been sowed with about two pounds of red clover-seed to the acre for pasture, yielded five tons of hay by the middle of June. A small piece of ground of similar quality, but without

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†

any plaster, produced only one ton and a half in the same proportion.—Mr Powel concludes in favour of the effects of the plaster upon arable as well as grass land.

Other accounts to the same purpose have been published, though it must also be remarked, that various persons who have made trial of this manure, declare themselves dissatisfied with it; but it does not appear that it has hitherto been at all tried in this part of the island.

When a soil abounds too much in particles of a particular kind, it has been found expedient to mix it with earth of a different character. Hence we are informed in the 12th volume of the Annals of Agriculture, that in Cornwall, large quantities of sea-sand are annually conveyed to the land, and laid upon the soil; a practice which will no doubt have a tendency to ameliorate stiff clays, and to render them more pervious to the roots of plants. With the same view, and also to save fuel, a practice is said to exist in the Netherlands, of baking up the dross or culm of coal, and also peat-earth, with clay, into lumps or bricks, which when dried in the air, make excellent fuel, and also afford an immense quantity of valuable ashes to be laid upon the land.

Drill or
Horse-
hoeing.
Husbandry.

SECT. VIII. *Principles and Operations of the Drill or Horse-hoeing Husbandry.*

THE general properties attributed to the new or drill husbandry may be reduced to two, viz. the promoting the growth of plants by hoeing, and the saving of seed; both of which are equally profitable to the farmer.

The advantages of tillage before sowing have already been pointed out. In this place we must confine ourselves to the utility of tillage after sowing. This kind of tillage is most generally known by the name of *horse-hoeing*.

⁴⁵²
Advanta-
ges ascribed
to horse-
hoeing.

Land sowed with wheat, however well it may be cultivated in autumn, sinks in the winter; the particles get nearer together, and the weeds rise; so that in spring, the land is nearly in the same situation as if it never had been ploughed. This, however, is the season when it should branch and grow with most vigour; and consequently stands most in need of ploughing or hoeing, to destroy the weeds, to supply the roots with fresh earth, and, by dividing anew the particles of the soil, to allow the roots to extend and collect nourishment.

It is well known, that, in gardens, plants grow with double vigour after being hoed or transplanted. If plants growing in arable land could be managed with ease and safety in this manner, it is natural to expect, that their growth would be promoted accordingly. Experience shows, that this is not only practicable, but attended with many advantages.

In the operation of hoeing wheat, though some of the roots be moved or broken, the plants receive no injury; for this very circumstance makes them send forth a greater number of roots than formerly, which enlarge their pasture, and consequently augment their growth.

Sickly wheat has often recovered its vigour after a good hoeing, especially when performed in weather not very hot or dry.

3 N

Wheat,

Drill or
Horse-
hoeing
Husbandry.

Wheat, and such grain as is sown before winter, requires hoeing more than oats, barley, or other grain sown in the spring; for, if the land has been well ploughed before the sowing of spring corn, it neither has time to harden, nor to produce many weeds, not having been exposed to the winter's snow and rain.

Of SOWING.

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Method of
sowing in
the drill
husbandry.

As in the practice of the new husbandry, plants grow with greater vigour than by the old method, the land should be sowed thinner. It is this principle of the new husbandry that has been chiefly objected to; for, upon observing the land occupied by a small number of plants, people are apt to look upon all the vacant space as lost. But this prejudice will soon be removed, when it is considered, that in the best land cultivated in the common method, and sown very thick, each seed produces but one or two ears; that, in the same land sown thinner, every seed produces two or three ears; and that a single seed sometimes produces 18 or 21 ears.

In the common method, as there are many more plants than can find sufficient nourishment, and as it is impossible to assist them by hoeing, numbers die before they attain maturity; the greatest part remain sickly and drooping; and thus part of the seed is lost. On the contrary, in the new method, all the plants have as much food as they require; and as they are, from time to time, assisted by hoeing, they become so vigorous as to equal in their production the numerous but sickly plants cultivated in the common method.

Of HOEING.

The new husbandry is absolutely impracticable in lands that are not easily ploughed. Attempting to cultivate land according to this husbandry, without attending to this circumstance, that it is practicable in no land excepting such as has already been brought into good tilth by the old method, has gone far to make it contemptible in many places.

When a field is in good tilth, it should be sown so thin as to leave sufficient room for the plants to extend their roots. After being well ploughed and harrowed, it must be divided into rows, at the distance of 30 inches from one another. On the sides of each of these rows, two rows of wheat must be sowed six inches distant from each other. By this means there will be an interval of two feet wide betwixt the rows, and every plant will have room enough to extend its roots, and to supply it with food. The intervals will likewise be sufficient for allowing the earth to be hoed or tilled without injuring the plants in the rows.

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The differ-
ent hoeings.

The first hoeing, which should be given before the winter, is intended to drain away the wet, and to dispose the earth to be mellowed by the frosts. These two ends will be answered by drawing two small furrows at a little distance from the rows, and throwing the earth taken from the furrows into the middle of the intervals. This first hoeing should be given when the wheat is in leaf.

The second hoeing, which is intended to make the plants branch, should be given after the hard frosts are over. To do this with advantage, after stirring the earth a little near the rows, the earth which was thrown

into the middle of the intervals should be turned back into the furrows. This earth, having been mellowed by the winter, supplies the plants with excellent food, and makes the roots extend.

The third hoeing, which is intended to invigorate the stalk, should be given when the ears of the corn begin to show themselves. This hoeing may, however, be very slight.

But the last hoeing is of the greatest importance, as it enlarges the grain, and makes the ears fill at their extremities. This hoeing should be given when the wheat is in bloom; a furrow must be drawn in the middle of the interval, and the earth thrown to the right and left on the foot of the plants. This supports the plants, prevents them from being laid, and prepares the ground for the next sowing, as the seed is then to be put in the middle of the ground that formed the intervals.

The best season for hoeing is two or three days after rain, or so soon after rain as the soil will quit the instrument in hoeing. Light dry soils may be hoed almost at any time, but this is far from being the case with strong clay soils; the season for hoeing such is frequently short and precarious; every opportunity therefore should be carefully watched, and eagerly embraced. The two extremes of wet and dry, are great enemies to vegetation in strong clay soils. There is a period between the time of clay soils running together, so as to puddle by superfluous wet, and the time of their caking by drought, in which they are perfectly manageable. This is the juncture for hoeing; and so much land as shall be thus seasonably hoed, will not cake or crust upon the surface, as it otherwise would have done, till it has been soaked or drenched again with rain; in which case the hoeing is to be repeated as soon as the soil shall quit the instrument, and as often as necessary; by which time the growing crop will begin to cover the ground, so as to act as a screen to the surface of the land against the intense heat of the sun, and thereby prevent, in a great measure, the bad effects of the soil's caking in dry weather.

By this successive tillage, or hoeing, good crops will be obtained, provided the weather is not very unfavourable.

But as strong vigorous plants are long before they arrive at maturity, corn raised in the new way is later in ripening than any other, and must therefore be sown earlier.

In order to prepare the intervals for sowing again, some well-rotted dung may be laid in the deep furrows made in the middle of the intervals; and this dung must be covered with the earth that was before thrown towards the rows of wheat. But, if the land does not require mending, the deep furrow is filled without any dung. This operation should be performed immediately after harvest, that there may be time to give the land a slight stirring before the rows are sowed; which should occupy the middle of the space which formed the intervals during the last crop. The intervals of the second year take up the space occupied by the stubble of the first.

Supposing dung to be necessary, which is denied by many, a very small quantity is sufficient; a single layer, put in the bottom of each furrow, will be enough.

DESCRIPTION.

Drill or
Horse-
hoeing
Husbandry.

Drill or
Horse-
hoeing
husbandry.

DESCRIPTION of the INSTRUMENTS commonly used in
the NEW HUSBANDRY.

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Instruments
described.
Plate X.

Fig. 1. is a marking plough. The principal use of this plough is to straight and regulate the ridges. The first line is traced by the eye, by means of three poles, placed in a straight line. The plough draws the first furrow in the direction of this line; and at the same time, with the tooth A, fixed in the block of wood near the end of the cross-pole or slider BB, marks the breadth of the ridge at the distance intended. The ploughman next traces the next line or rutt made by the tooth, and draws a small furrow along it: and continues in this manner till the whole field is laid out in straight and equidistant ridges.

Fig. 2. is a plough for breaking up ley, or turning up the bottom of land when greatly exhausted. By its construction, the width and depth of the furrows can be regulated to a greater certainty than by any other hitherto known in this country. Its appearance is heavy: but two horses are sufficient to plough with it in ordinary free land; and only four are necessary in the stiffest clay-soils. The plough is likewise easily held and tempered. A, is the sword fixed in the sizers B, which runs through a mortise E, at the end of the beam C, and regulates the depth of the furrow by raising or depressing the beam; it is fixed by putting the pin D through the beam and sword, and is moveable at E.

late X.

Fig. 3. is a jointed brake-harrow with 24 teeth, shaped like coulters, and standing at about an angle of 80 degrees. By this instrument the land is finely pulverized, and prepared for receiving the seed from the drill. It requires four horses in stiff, and two in open land. This harrow is likewise used for leveling the ridges; which is done by pressing it down by the handles where the ridge is high, and raising it up when low.

Fig. 4. is an angular weeding harrow, which may follow the brake when necessary. The seven hindmost teeth should stand at a more acute angle than the rest, in order to collect the weeds, which the holder can drop at pleasure, by raising the hinder part, which is fixed to the body of the harrow by two joints.

Fig. 5. is a pair of harrows with shafts. This harrow is used for covering the seed in the drills, the horse going in the furrow.

Fig. 6. is a drill-plough, constructed in such a manner as to sow at once two rows of beans, pease, or wheat. This machine is easily wrought by two horses. A, is the happer for containing the seed; B, circular boxes for receiving the seed from the happer; CC, two square boxes which receive the seed from small holes in the circular boxes, as they turn round; and, last of all, the seed is dropped into the drills through holes in the square boxes, behind the coulters D. The cylinder E follows, which, together with the wheel F, regulates the depth of the coulters and covers the seed; the harrow G comes behind all, and covers the seed more completely. HH, two sliders, which, when drawn out, prevent the seed from falling into the boxes; and, I, is a ketch which holds the rungs, and prevents the boxes from turning, and losing seed at the ends of the ridges.

Fig. 7. is a single hoe-plough of a very simple construction, by which the earth in the intervals is stirred and laid up on both sides to the roots of the plants, and at the same time the weeds are destroyed. AA the mouldboards, which may be raised or depressed at pleasure, according as the farmer wants to throw the earth higher or lower upon the roots.

Fig. 2. is a drill-rake for pease. This instrument, which is chiefly calculated for small inclosures of light grounds, is a sort of strong plough rake, with four large teeth at *a, a, b, b*, a little incurvated. The distance from *a* to *a*, and from *b* to *b*, is nine inches. The interval between the two inner teeth, *a* and *b*, is three feet six inches, which allows sufficient room for the hole-plough to move in. To the piece of timber *c c*, forming the head of the rake, are fixed the handles *d*, and the beam *e* to which the horse is fastened. When this instrument is drawn over a piece of land made thoroughly fine, and the man who holds it bears upon the handles, four furrows, *f, g, h, i*, will be formed, at the distances determined by the construction of the instrument. These distances may be accurately preserved, provided that the teeth *a a* return when the ploughman comes back, after having ploughed one turn, in two of the channels formed before, marked *bb*: thus all the furrows in the field will be traced with the same regularity. When the ground is thus formed into drills, the pease may be scattered by a single motion of the hand at a certain distance from one another into the channels, and then covered with the flat part of a hand-rake, and pressed down gently. This instrument is so simple, that any workman may easily make or repair it.

On Plate XI. is delineated a patent drill machine, lately invented by the Reverend James Cooke of Heaton Norris near Manchester. A, the upper part of the seed box. B, the lower part of the same box. C, a moveable partition, with a lever, by which the grain or seed is let fall at pleasure from the upper to the lower part of the seed-box, from whence it is taken up by cups or ladles applied to the cylinder D, and dropped into the funnel E, and conveyed thereby into the furrow or drill made in the land by the coulter F, and covered by the rake or harrow G. H, a lever, by which the wheel I is lifted out of gear with the wheel K, to prevent the grain or seed being scattered upon the ground, while the machine is turning round at the end of the land, by which the harrow G is also lifted from the ground at the same time, and by the same motion, by means of the crank, and the horizontal lever *h h*. L, a sliding lever, with a weight upon it, by means of which the depth of the furrows or drills, and consequently the depth that the grain or seed will be deposited in the land, may be easily ascertained. M, a screw in the coulter beam, by turning of which the seed-box B is elevated or depressed, in order to prevent the grain or seed being crushed or bruised by the revolution of the cups or ladles. Fig. 13. a rake with iron teeth, to be applied to the under side of the rails of the machine, with staples and screw nuts at *n n*, by which many useful purposes are answered, viz. in accumulating cutch or hay into rows, and as a scarificator for young crops of wheat in the spring, or to be used upon a fallow; in which case, the seed-box, the ladle cylinder, the coulters, the funnels, and harrows, are all taken away.

Drill or
Horse-
hoeing
husbandry.

Plate IX.

Plate XI.

Drill or
Horse-
hoeing
Husbandry.

The side view of the machine is represented, for the sake of perspicuity, with one seed-box only, one coulter, one funnel, one harrow, &c. whereas a complete machine is furnished with five coulters, five harrows, seven funnels, a seed-box in eight partitions, &c. with ladles of different sizes, for different sorts of grain and seeds.

These machines (with five coulters, sixteen guineas, with four coulters fifteen guineas), equally excel in setting or planting all sorts of grain or seeds, even carrot-seed, to exactness, after the rate of from eight to ten chain acres per day, with one man, a boy, and two horses. They deposite the grain or seed in any given quantity, from one peck to three bushels per acre, regularly and uniformly, and that without grinding or bruising the seed, and at any given depth, from half an inch to half a dozen inches, in rows at the distance of twelve, sixteen, and twenty-four inches, or any other distance. They are equally useful on all lands, are durable, easy to manage, and by no means subject to be put out of repair.

The ladle cylinder D is furnished with cups or ladles of four different sizes for different sorts of grain or seeds, which may be distinguished by the numbers 1, 2, 3, 4.—N^o 1. (the smallest size) is calculated for turnip-seed, clover-seed, cole-seed, rape, &c. and will sow something more than one pound per statute acre. N^o 2. for wheat, rye, hemp, flax, &c. and will sow something more than one bushel per acre. N^o 3. for barley; and will sow one bushel and a half per acre. N^o 4. for beans, oats, pease, vetches, &c. and will sow two bushels per acre.

Notwithstanding the above specified quantities of grain or seeds, a greater or less quantity of each may be sown at pleasure, by stopping up with a little clay or by adding a few ladles to each respective box. The grain or seeds intended to be sown, must be put in those boxes, to which the cups or ladles as above described respectively belong, an equal quantity into each box, and all the other boxes empty. The ladle cylinder may be reversed, or turned end for end at pleasure, for different sorts of grain, &c.

For sowing beans, oats, pease, &c. with a five coulter machine, four large ladles must occasionally be applied at equal distances round those parts of the cylinder which subtend the two end boxes. And for sowing barley, eight large ones must be applied as above; or four ladles, N^o 2. to each of the wheat boxes. These additional ladles are fixed on the cylinder with nails, or taken off in a few minutes; but for sowing with a four-coulter machine, the above alterations are not necessary.

The funnels are applied to their respective places by corresponding numbers. Care should be taken, that the points of the funnels stand directly behind the backs of the coulters, which is done by wedges being applied to one side or other of the coulters, at the time they are fixed in their respective places.

The machine being thus put together, which is readily and expeditiously done, as no separate part will coincide with any other but that to which it respectively belongs, and an equal quantity of grain or seed in each of the respective boxes, the land also being previously ploughed and harrowed once or so in a place to level the surface; but if the land be very rough, a rol-

ler will best answer that purpose, whenever the land is dry enough to admit of it; and upon strong clays a spiked roller is sometimes necessary to reduce the size of the large dry clods; which being done, the driver should walk down the furrow or edge of the land, and having hold of the last horse's head with his hand, he will readily keep him in such a direction, as will bring the outside coulter of the machine within three or four inches of the edges of the land or ridge, at which uniform extent, he should keep his arm till he comes to the end of the land; where having turned round, he must come to the other side of his horses, and walking upon the last outside drill, having hold of the horse's head with his hand as before, he will readily keep the machine in such a direction, as will strike the succeeding drill at such a distance from the last outside one, or that he walks upon, as the coulters are distant from each other.

The person who attends the machine should put down the lever H soon enough at the end of the land, that the cups or ladles may have time to fill, before he begins to sow; and at the end of the land, he must apply his right hand to the middle of the rail between the handles, by which he will keep the coulters in the ground, while he is lifting up the lever H with his left hand, to prevent the grain being scattered upon the headland, while the machine is turning round; this he will do with great ease, by continuing his right hand upon the rail between the handles, and applying his left arm under the left handle, in order to lift the coulters out of the ground while the machine is turning round.

If there be any difficulty in using the machine, it consists in driving it straight. As to the person who attends the machine, he cannot possibly commit any errors, except such as are wilful, particularly as he sees at one view the whole process of the business, viz. that the coulters make the drills of a proper depth; that the funnels continue open to convey the grain or seed into the drills; that the rakes or harrows cover the grain sufficiently; and when seed is wanting in the lower boxes B, which he cannot avoid seeing, he readily supplies them from the upper boxes A, by applying his hand, as the machine goes along, to the lever C. The lower boxes B should not be suffered to become empty before they are supplied with seed, but should be kept nearly full, or within an inch or so of the edge of the box.

If chalk lines are made across the backs of the coulters, at such a distance from the ends as the seed should be deposited in the ground (viz. about two inches for wheat, and from two to three for spring corn), the person that attends the machine will be better able to ascertain the depth the seed should be deposited in the drills, by observing, as the machine goes along, whether the chalk lines are above or below the surface of the land; if above, a proper weight must be applied to the lever L, which will force the coulters into the ground; if below, the lever L and weight must be reversed, which will prevent their sinking too deep.

In different parts of the kingdom, lands or ridges are of different sizes; where the machine is too wide for the land, one or more funnels may occasionally be stopped with a little loose paper, and the seed received into

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into such funnel returned at the end of the land, or sooner if required, into the upper seed-box. But for regularity and expedition, lands consisting of so many feet wide from outside to outside, as the machine contains coulter, when fixed at twelve inches distance, or twice or three times the number, &c. are best calculated for the machine. In wet soils or strong clays, lands or ridges of the width of the machine, and in dry soils, of twice the width, are recommended. For sowing of narrow high-ridged lands, the outside coulters should be let down, and the middle ones raised, so that the points of the coulters may form the same curve that the land or ridge forms. And the loose soil harrowed down into the furrows should be returned to the edges of the lands or ridges from whence it came, by a double mouldboard or other plough, whether the land be wet or dry.

Clover or other leys, intended to be sown by the machine, should be ploughed a deep strong furrow and well harrowed, in order to level the surface, and to get as much loose soil as possible for the coulters to work in; and when sown, if any of the seed appears in the drills uncovered by reason of the stiff texture of the soil, or toughness of the roots, a light harrow may be taken over the land, once in a place, which will effectually cover the seed, without displacing it all in the drills. For sowing leys, a considerable weight must be applied to the lever L, to force the coulters into the ground; and a set of wrought-iron coulters, well steeled, and made sharp at the front edge and bottom, are recommended; they will pervade the soil more readily, consequently require less draught, and expedite business more than adequate to the additional expence.

For every half acre of land intended to be sown by the machine with the seed of that very valuable root, carrot, one bushel of saw-dust, and one pound of carrot-seed, should be provided; the saw-dust should be made dry, and sifted to take out all the lumps and chips, and divided into eight equal parts or heaps; the carrot-seed should likewise be dried, and well rubbed between the hands, to take off the beards, so that it may separate readily; and being divided into eight equal parts or heaps, one part of the carrot-seed must be well mixed with one part of the saw-dust, and so on, till all the parts of carrot-seed and saw-dust are well mixed and incorporated together; in which state it may be sown very regularly in drills at twelve inches distance, by the cups or ladles N^o 2. Carrot-seed resembling saw-dust very much in its size, roughness, weight, adhesion, &c. will remain mixed as above during the sowing; a ladleful of saw-dust will, upon an average, contain three or four carrot-seeds, by which means the carrot-seed cannot be otherwise than regular in the drills. In attempting to deposite small seeds near the surface, it may so happen that some of the seeds may not be covered with soil: in which case, a light roller may be drawn over the land after the seed is sown, which will not only cover the seeds, but will also, by levelling the surface, prepare the land for an earlier hoeing than could otherwise have taken place.

It has always been found troublesome, sometimes impracticable, to sow any kind of grain or seeds (even broad-cast) in a high wind. This inconvenience is en-

tirely obviated by placing a screen of any kind of cloth, or a sack, supported by two uprights nailed to the sides of the machine, behind the funnels, which will prevent the grain or seed being blown out of its direction in falling from the ladles into the funnels. Small pipes of tin may also be put on to the ends of the funnels, to convey the grain or seed so near the surface of the land, that the highest wind shall not be able to interrupt its descent into the drills.

Respecting the use of the machine, it is frequently remarked by some people not conversant with the properties of matter and motion, that the soil will close after the coulters, before the seed is admitted into the drills. Whereas the very contrary is the case; for the velocity of the coulters in passing through the soil, is so much greater than the velocity with which the soil, closes up the drills by its own spontaneous gravity, that the incisions or drills will be constantly open for three or four inches behind the coulters; by which means it is morally impossible (if the points of the funnels stand directly behind the coulters) that the seed, with the velocity it acquires in falling through the funnels, shall not be admitted into the drills.

Fig. 12. is a new constructed simple hand-hoe, by Plate XL. which one man will effectually hoe two chain acres *per* day, earthing up the soil at the same time to the rows of corn or pulse, so as to cause roots to issue from the first joint of the stem, above the surface of the land, which otherwise would never have existed.

This hoe is worked much in the same manner as a common Dutch hoe, or scuffle, is worked in gardens. The handle is elevated or depressed, to suit the size of the person that works it, by means of an iron wedge being respectively applied to the upper or under side of the handle that goes into the socket of the hoe.

The wings or moulding plates of the hoe, which are calculated to earth up the soil to the rows of corn, so as to cause roots to issue from the first joint of the stem above the surface, which otherwise would not have existed, should never be used for the first hoeing, but should always be used for the last hoeing, and used or not used, at the option of the farmer, when any intermediate hoeing is performed.

Comparative Advantages and Disadvantages of the New and Old Systems.

We pretend not to determine whether the old or new husbandry be preferable in every country. With regard to this point, the climate, the situation of particular land, skill and dexterity in managing the machinery, the comparative expence in raising crops, and many other circumstances, must be accurately attended to, before a determination can be given.

To give an idea of the arguments by which the drill husbandry was originally supported, we shall here take notice of a comparative view of the old and new methods of culture which was furnished for the editors of Mr Tull's Horse-Hoeing Husbandry, by a gentleman who for some years practised both in a country where the soil was light and chalky, like that from which he drew his observations. It is necessary to remark, that in the new husbandry every article is stated at its full value, and the crop of each year is four bushels short of the other; though,

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though, in several years experience, it has equalled and generally exceeded those in the neighbourhood in the old way.

"An estimate of the expence and profit of 10 acres of land in 20 years.

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Comparative
view
of the ex-
pence and
profits of
the old and
new hus-
bandry.

I. In the old way.

First year, for wheat, costs 33l. 5s.					
viz.	L.	s.	d.	L.	s.
First ploughing, at 6s. per acre	3	0	0		
Second and third ditto, at 8s.					
per acre	4	0	0		
Manure, 30s. per acre	15	0	0		

Two harrowings, and sowing,				22	0
at 2s. 6d. per acre	1	5	0		
Seed, three bushels per acre, at					
4s. per bushel	6	0	0		
Weeding, at 2s. per acre	1	0	0		
Reaping, binding, and carry-					
ing, at 6s. per acre	3	0	0		

Second year, for barley, costs				11	5
11s. 6s. 8d. viz.					
Once ploughing, at 6s. per					
acre	3	0	0		
Harrowing and sowing, at					
1s. 6d. per acre	0	15	0		
Weeding, at 1s. per acre	0	10	0		
Seed, four bushels per acre,					
at 2s. per bushel	4	0	0		
Cutting, raking, and carrying,					
at 3s. 2d. per acre	1	11	8		
Grass seeds, at 3s. per acre	1	10	0		

Third and fourth years, lying in grass,					
cost nothing; so that the expence of					
ten acres in four years comes to 44l.					
11s. 8d. and in twenty years to				222	18

First year's produce is half a					
load of wheat per acre, at 7l.	35	0	0		
Second year's produce is two					
quarters of barley per acre,					
at 1l.	20	0	0		
Third and fourth years grass					
is valued at 1l. 10s. per acre	15	0	0		
So that the produce of ten					
acres in four years is	70	0	0		
And in 20 years it will be				350	0

Deduct the expence, and there remains					
clear profit on ten acres in twenty					
years by the old way	127	1	8		

II. In the new way.

First year's extraordinary expence is, for ploughing and manuring the land, the same as in the old way, L. 22 0 0

L. s. d. L. s. d. Drill or
Horse-
hoeing
Husbandry.

Ploughing once more, at 4s.			
per acre	2	0	0
Seed, nine gallons per acre, at			
4s. per bushel	2	5	0
Drilling, at 7d. per acre	0	5	10
Hand-hoeing and weeding, at			
2s. 6d. per acre	1	5	0
Horse-hoeing six times, at			
10s. per acre	5	0	0
Reaping, binding, and carry-			
ing, at 6s. per acre	3	0	0
The standing annual charge			
on ten acres, is	13	15	10

Therefore the expence on ten acres in			
twenty years is	275	16	8
Add the extraordinaries of the first year,			
and the sum is	297	16	8
The yearly produce is at least two quar-			
ters of wheat per acre, at 11. 8s. per			
quarter; which on ten acres in twenty			
years, amounts to	560	0	0
Therefore, all things paid, there remains			
clear profit on ten acres in twenty years			
by the new way	262	3	4

"So that the profit on ten acres of land in twenty years, in the new way, exceeds that in the old by 135l. 1s. 8d. and consequently is considerably more than double thereof; and ample encouragement to practise a scheme, whereby so great advantage will arise from so small a quantity of land, in the compass of a twenty-one years lease; one year being allowed, both in the old and new way, for preparing the ground.

"It ought withal to be observed, that Mr Tull's husbandry requires no manure at all, though we have here, to prevent objections, allowed the charge thereof for the first year; and moreover, that though the crop of wheat from the drill-plough is here put only at two quarters on an acre, yet Mr Tull himself, by actual experiment and measure, found the produce of his drilled wheat crop amounted to almost four quarters on an acre."

It appears also from a comparative calculation of expence and profit between the drill and common husbandry, taken from Mr Baker's report to the Dublin Society, of his experiments in agriculture for the year 1765, that there is a clear profit arising upon an Irish acre of land in 15 years, in the drill husbandry, of 52l. 3s. 11d. and in the common husbandry, of 27l. 19s. 2d.; and therefore a greater profit in the drilled acre in this time of 24l. 4s. 9d. which amounts to 1l. 12s. 3½d. per annum. From hence he infers, that in every 15 years, the fee-simple of all the tillage-lands of the kingdom is lost to the community by the common course of tillage. In stating the accounts, from which their result is obtained, no notice is taken of fences, water-cutting the land, weeding and reaping, because these articles depend on a variety of circumstances, and will, in general, exceed in the common husbandry those incurred by the other.

Besides, the certainty of a crop is greater in this new way

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Arguments
in favour of
the drill
husbandry.

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way than in the old way of sowing; for most of the accidents attending wheat crops are owing to their being late sown, which is necessary to the farmer in the old way; but in the horse-hoeing method, the farmer may plough two furrows whereon the next crop is to stand immediately after the first crop is off. In this manner of husbandry, the land may be ploughed dry and drilled wet, without any inconvenience; and the seed is never planted under the furrow, but placed just at the depth which is most proper, that is, at about two inches; in which case it is easy to preserve it, and there is no danger of burying it. Thus the seed has all the advantage of early sowing, and none of the disadvantages that may attend it in the other way, and the crop is much more certain than by any other means that can be used.

The condition in which the land is left after the crop, is no less in favour of the horse-hoeing husbandry than all the other articles. The number of plants is the great principle of the exhausting of land. In the common husbandry, the number is vastly greater than in the drilling way, and three plants in four often come to nothing, after having exhausted the ground as much as profitable plants; and the weeds which live to the time of harvest in the common way, exhaust the land no less than so many plants of corn, often much more. The horse-hoeing method destroys all the weeds in the far greater part of the land, and leaves that part unexhausted and perfectly fresh for another crop. The wheat plants being also but a third part of the number at the utmost of those in the sowing way, the land is so much the less exhausted by them; and it is very evident from the whole, that it must be, as experience proves that it is, left in a much better condition after this than after the common husbandry.

The farmers who are against this method object, that it makes the plants too strong, and that they are more liable to the blacks or blights of insects for that reason; but as this allows that the hoeing can, without the use of dung, give too much nourishment, it is very plain that it can give enough; and it is the farmer's fault if he do not proportion his pains so as to have the advantage of the nourishment without the disadvantages. It is also objected, that as hoeing can make poor land rich enough to bear good crops of wheat, it may make good land too rich for it. But if this should happen, the sowing of wheat on it may be let alone a while, and in the place of it the farmer may have a crop of turnips, carrots, cabbages, and the like, which are excellent food for cattle, and cannot be over-nourished: or, if this is not chosen, the land, when thus made too rich, may soon be sufficiently impoverished by sowing corn upon it in the common old way.

The method of horse-hoeing husbandry, so strongly recommended by Mr Tull, is objected to by many on account of the largeness of the intervals which are to be left between the rows of corn. These are required to be about five feet wide; and it is thought that such wide spaces are so much lost earth, and that the crop is to be so much the less for it. But it is to be observed, that the rows of corn separated by these intervals need not be single; they may be double, triple, or quadruple, at the pleasure of the farmer; and four rows thus standing as one will have the five feet interval but one-fourth of its bigness as to the whole quan-

tity, and it will be but as fifteen inch intervals to plants in single rows. Corn that is sown irregularly in the common way, seems indeed to cover the ground better than that in rows; but this is a mere *deceptio visus*; for the stalks of corn are never so thick as when they come out of one plant, or as when they stand in a row; and a horse-hoed plant of corn will have 20 or 30 stalks in a piece of ground of the same quantity, where an unhoed plant will have only two or three stalks. If these stalks of the hoed plant were separated and planted over the intervals, the whole land would be better covered than it is in the common way; and the truth is, that though these hoed fields seem to contain a much less crop than the common sown fields, yet they in reality do contain a much greater. It is only the different placing that makes the sown crop seem the larger, and even this is only while both crops are young.

The intervals are not lost ground, as is usually supposed, but when well horse-hoed they are all employed in the nourishment of the crop: the roots of the plants in the adjoining rows spreading themselves through the whole interval, and drawing such nourishment from it, that they increase accordingly. When the plants stand in the scattered way, as in common sowing, they are too close to one another; each robs its neighbours of part of their nourishment, and consequently the earth is soon exhausted, and all the plants half starved. The close standing of them also prevents the benefit of after-tilling, as the hoe cannot be brought in, nor the ground by any means stirred between them, to give it a new breaking and consequently afford them new food.

Experiments have abundantly proved, that in large grounds of wheat, where the different methods have been tried, those parts where the intervals were largest have produced the greatest crops, and those where hoeing was used without dung have been much richer than those where dung was used without hoeing. If it were possible that plants could stand as thick, and thrive as well over the whole surface of the ground, as they do in the rows separated by these large intervals, the crops of corn so produced would be vastly greater than any that have been heard of; but the truth is, that plants receive their growth not according to the ground they stand on, but to the ground they can extend their roots into; and therefore a single row may contain more plants than a large interval can nourish, and therefore the same number that stand in that row, and no more than these, could be nourished, if scattered over the whole interval: and they would be much worse nourished in that way; because, while the interval is void, the earth may be stirred about them, and new roots will be formed in great numbers from every one broken by the instruments, and new nourishment laid before these roots by the breaking the particles of earth, by which the plants will have supplies that they cannot have when scattered over the whole surface, because the ground is then all occupied, and cannot be moved between the plants.

All soils and all situations are not equally proper for this method of planting in rows, with large intervals and hoeing between. The lightest soils seem to be best for it, and the tough and wet clays the worst. Such grounds as lie on the sides of hills are also less proper than others for this work.

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This method is not so proper in common fields, but that not in respect of the soil, but of the husbandry of the owners, who are usually in the old way, and change the species of corn, and make it necessary to fallow every second, third, or fourth year. Nevertheless it has been found by later experiments, that the intervals between the rows of plants, as recommended by Mr Tull, were too great, perhaps double of what they should be in the most profitable method of culture; by which means much less crops are obtained than might be produced at nearly the same expence. This has rendered the profits of the drill method much less than they would have been in a more judicious practice, and, consequently, has proved a great disadvantage to it in comparison with the broadcast. Mr Tull was led into this, partly from the want of more perfect instruments for hoeing, and of ploughs proper for drilling.

To the preceding statements, the following observations by Sir John Anstruther, published among the Select Papers of the Bath Society, may not be improperly subjoined.

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Observa-
tions by Sir
John An-
struther.

The slow progress which the drill husbandry has made in many parts of Great Britain since Mr Tull's time, he observes, has been principally owing to the want of proper drill-ploughs. Before drilling can become general, those ploughs must be simple, such as a common ploughman accustomed to use such instruments can use without breaking, and such also as common workmen can easily make or repair. Mathematical accuracy he considers as not required for delivering the seed: for it matters very little whether there be a quarter of a peck more or less sown, if it be delivered with tolerable regularity. He therefore had a plough made, according to his own directions, by a common plough-wright, of sufficient strength for any land made fit for turnips or wheat. It was tried on very rough ground unfit for sowing, in order to ascertain its strength; and it had been used for eight years without its needing any repair. It is a double drill-plough, which sows two ridges at a time, the horse going the furrow between them, and of course does not tread upon the ground intended to be sown; which with a single drill must be the case, and does much harm by the horses feet sinking and making holes in the fine ground, which retain the water, and hurt the wheat when young.

He proceeds to observe, "That having read Mr Forbes upon the extensive practice of the new husbandry, and some other authors, who give a more clear and distinct account of the different operations in drilling than had heretofore been given, I wished to try them, and to adapt my plough to sow the quantities therein directed. It was, however, adjusted to sow a smaller quantity, and the seed was not steeped.

"Not having ground so proper as I wished, it was drilled on the side of a field, the soil of which was light and sandy, and in such bad order, that the preceding crop was a very indifferent one. It was therefore manured with a compost dunghill.

"After cross-ploughing and manuring, it was laid into four and a half feet ridges, then harrowed and drilled with one peck and a half of wheat on an acre and a quarter, which is nearly one peck and a fifth per

English acre. It was drilled the 27th of October, and rolled after drilling. The crop was late in its appearance, and very backward in the spring.

"March 31st, it was horse-hoed one furrow *from* the rows.

"April 8th, it was hand-hoed and weeded in the rows.

"25th, horse-hoed again, laying a furrow back to the rows.

"May 15th, hand-hoed the second time.

"June 2d, horse-hoed *from* the rows.

"June 12th, hand-hoed the third time.

"July 14th, horse-hoed *to* the rows.

"At this last hoeing, as many of the ears were beaten down into the intervals by wind and rain, a man went before the horse-hoe, and turned the ears back into their proper place.

"The crop when reaped and threshed, yielded me 36 bushels on one acre and a quarter, which is 28 bushels and three pecks per acre; and the produce from one peck and half 96 for one.

"As the produce appeared so great, from land in such bad order, it was carefully measured again, and found to be right. But this increase, though great, was not so large as Mr Crake of Glasgow had without dung.

"Mr Randal says, 'It is an experimental fact, that on a fine loam exquisitely prepared, 144 bushels have been produced from one acre. And, I believe, it is not known what the increase may be brought to in rich lands by high cultivation.'

"Some years since, I had beans dropt alternately with potatoes, at two feet distance in the rows, which were three feet apart, and ploughed in the intervals. The land adjoining was sown with beans and pease, which were a good crop; but those sown among the potatoes a better one. I pulled one stem of the beans planted with the potatoes, which had three branches rising from the bottom, and it produced 225 beans. In all the trials of drilled beans, most of the stems had two branches, with many pods upon each.—From these and other instances, I believe it is not yet known to what increase grain may be brought by drilling, good cultivation, and manure.

"Horse-hoeing is certainly preferable to close drilling or hand-hoeing; but the latter is superior to broadcast.

"Horse-hoeing the full depth increases the crop, by making it tiller or branch more than it otherwise would do; and the advantage is distinctly observable every hoeing, by the colour of the grain. It prepares the ground for the next crop, at the same time that it increases the crop growing, which hand-hoeing does not, although it may destroy the weeds. Thus drilled ground is kept in a loose open state to receive the benefit of the influence of the air and weather, which broadcast has not; and it is evident from certain experience, that crops may be drilled many years to good advantage without manure.

"Suppose the crops only 20 bushels per acre, what course of broadcast-crops will give 5l. an acre for the course? But suppose they are dunged the same as any ground in the most approved course, there is the greatest reason to expect as much as in the above experiment,

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ment, which is $28\frac{1}{2}$, and at 5s. per bushel, amounts to 7l. 3s. 9d.

"Calculations may be of service to those who wish to try drilling, and have few books to direct them.

"One acre is 10 chains long, of 660 feet or 220 yards long, and one yard broad, containing 4840 square yards. Then if the ridge is four feet six inches, this makes 24 ridges, and three feet to spare. This length of 220 yards multiplied by 14 (the number of ridges), gives a length of yards 3080, to which add 149 for the spare three feet, and it will be 3226 yards. And as two rows are drilled on a ridge, the number of rows will be in length 6452 yards; but as a deduction of 172 yards must be made for the head ridges, suppose three yards each, &c. the whole length to be sown will be 6280 yards clear. Now a gallon (Winchester) holds about 80,000 grains. The quantity, recommended to be drilled by Mr Forbes and others, being six gallons, or two-thirds of a bushel, per acre, is nearly 78 grains to a yard, or 26 to a foot. But in my experiment, by this calculation, it was only about 11 grains to a foot: which is quite sufficient, if the seed be good, and it be not destroyed by vermine.

"Now with regard to the quantity of land this drill plough may sow; if a horse walks at the rate of two miles per hour, he goes 16 miles in eight hours, or 28,460 yards. As he sows two ridges at once, this is seven lengths and two-thirds per acre, or 1686 yards to sow an acre, being nearly 17 acres in a day.

"Four horse-hoings are calculated equal to two ploughings. In plain ploughing they suppose the ridge is ploughed with four furrows, or eight for twice ploughing. The four horse-hoings are eight furrows, equal to two ploughings.

"Mr Tull directs four hoeings, and Mr Forbes five. 1st, In November, when the plant has four blades. 2dly, In March, deep, and nearer the rows than the former; both these hoeings should be *from* the rows. 3dly, Hand-hoed when it begins to spindle, if the earth be crumbly, *to* the rows. 4thly, When it begins to blossom, *from* the rows, but as near to them as in the second hoeing. 5thly, When done blossoming, to ripen and fill the grain, *to* the rows.

"The last hoeing Mr Tull does not direct, but Mr Forbes advises it, as being of essential service in filling the grain, and saving trouble in making the next seed-furrows. They advise the patent or sowing-plough for horse-hoeing; and the expence is calculated by Mr Craik at one guinea per acre, reaping included.

"But let us suppose the following, which are the prices in the county I live in (Fife).

	L.	s.	d.
Ploughing to form the ridges,	-	-	0 4 0
Harrowing,	-	-	0 0 4
Four hoeings, equal to two ploughings,	0	8	0
Sowing	-	-	0 0 4
Hand-hoeing twice,	-	-	0 8 0
Seed, one peck and a half at 5s. a bushel	0	1	10

Whole expence per acre, L. 1 2 6"

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Drill husbandry is, as a good writer has justly defined it, "*the practice of a garden brought into the field.*" Every man of the least reflection must be sensible, that the practice of the garden is much *better* than that of

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the field, only a little more expensive; but if (as is the case) this extra expence be generally much more than repaid by the superior goodness and value of drilled crops, it ought to have no weight in comparing the two modes of husbandry.

In the broad-cast method the land is often sown in bad tilth, and always scattered at random, sometimes by very unskillful hands. In drilling, the land must be in fine order; the seed is set in trenches drawn regularly; all of nearly an equal depth, and that depth suited to the nature of each kind of seed. These seeds are also distributed at proper distances, and by being equally and speedily covered, are protected from vermine and other injuries; so that the practice of the garden is here exactly introduced into the field.

In the broad-cast method the seed falls in some places too thick; in others too thin; and being imperfectly covered, a part of it is devoured by vermine which follow the sower; another part is left exposed to rain or frost, or to heats, which greatly injure it. When harrowed, a great part of it (small seeds especially) is buried so deep, that, if the soil be wet, it perishes before it can vegetate.

Again: When thus sown, there is no meddling with the crop afterwards, because its growth is irregular. The soil cannot be broken to give it more nourishment, nor can even the weeds be destroyed without much inconvenience and injury.

But in the drill-husbandry the intervals between the rows, whether double or single, may be horse-hoed; and thereby nourishment may repeatedly be given to the plants, and the weeds almost totally destroyed.

The very same effects which digging has upon young shrubs and trees in a garden, will result from horse-hoeing in a field, whether the crop be corn or pulse: For the reason of the thing is the same in both cases, and being founded in nature and fact, cannot ever fail. In drilling, no more plants are raised on the soil than it can well support: and by dividing and breaking the ground, they have the full advantage of all its fertility.

The plough prepares the land for a crop, but goes no further; for in the broad-cast husbandry it cannot be used: but the crop receives greater benefit from the tillage of the land by the horse-hoe, while it is growing, than it could in the preparation. No care in tilling the land previous to sowing can prevent weeds rising with the crop; and if these weeds be not destroyed while the crop is growing, they will greatly injure it. In the broad-cast husbandry this cannot be done; but in drilling, the horse-hoe will effect it easily.

And what adds to the farmer's misfortune is, that the most pernicious weeds have seeds winged with down, which are carried by the wind to great distances; such as thistles, sow-thistles, colts-foot, and some others.

If the expence of horse-hoeing be objected, there are two answers which may very properly be made: The first is, that this expence is much less than that of hand-hoeing were it practicable, or of hand-weeding. The second is, that it is more than repaid by the quantity of seed saved by drilling; to say nothing of the extra quantity and goodness of the crops, which are generally self-evident.

Upon the whole, if the particular modes of cultivating land by the new husbandry should, after all, be considered

Flax and
Hemp.

considered as perhaps too limited to be universally adopted; yet it has been of great use in raising suspicions concerning the old method, and in turning the views of philosophers and farmers towards improving in general. Many real improvements in agriculture have been the consequences of these suspicions; and as this spirit of inquiry remains in full vigour, a solid foundation is laid for expecting still further improvements in this useful art.

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The drill-
husbandry
is not a mo-
dern disco-
very.

It may be proper here to remark, however, that the drill-husbandry is by no means a modern European invention. It is now used in the Carnatic, and in all

probability has existed among the industrious nations of India from a very early period. It is used not only for all grains, but also for the culture of tobacco, cotton, and the castor oil plant. Besides the drill-plough, and the common plough, the Indians use a third, with a horizontal share, which immediately follows the drill-plough at work. It is set in the earth, about the depth of 7 or 8 inches, and passes under three drills at once. It operates by agitating the earth, so as to make the sides of the drills fall in and cover the seed, which it does so effectually as scarcely to leave any traces of a drill.

Flax and
Hemp.

PART II. CULTIVATION OF VEGETABLES MORE PROPERLY ARTICLES OF COMMERCE.

THESE in general are such as cannot be used for food; and are principally flax, hemp, rape, hops, and timber of various kinds. Of each of these we shall treat particularly in the following sections.

SECT. I. Of *Flax and Hemp*.

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Flax and
hemp.

FLAX is cultivated not only with a view to the common purposes of making linen, but for the sake of its seed also; and thus forms a most extensive article of commerce; all the oil used by painters, at least for common purposes, being extracted from this seed. The cake which remains after the extraction of the oil is in some places used as a manure, and in others sold for fattening of cattle. In the Vale of Gloucester, Mr Marshall informs us, that it is, next to hay, the main article of stall-fattening; though the price is now become so great, that it probably leaves little or no profit to the consumer, having within a few years risen from three guineas to six and six and a half, and the lowest price being five guineas per ton; and even this is lower than it was lately. Hence some individuals have been induced to try the effect of linseed itself boiled to a jelly, and mixed with flour, bran, or chaff, with good success, as Mr Marshall has been informed; and even the oil itself has been tried for the same purpose in Herefordshire. Though this plant is in universal culture over the whole kingdom, yet it appears, by the vast quantity imported, that by far too little ground is employed in that way. As Mr Marshall takes notice of its culture only in the county of Yorkshire, it probably does not make any great part of the husbandry of the other counties of which he treats; and even in Yorkshire, he tells us that its cultivation is confined to a few districts. The kind cultivated there is that called *blea-line*, or the *blue* or *lead-coloured flax*, and this requires a rich dry soil for its cultivation. A deep, fat, sandy loam is perhaps the only soil on which it can be cultivated with advantage. If sown upon old corn land, it ought to be well cleaned from weeds, and rendered perfectly friable by a summer-fallow. Manure is seldom or ever set on for a line crop: and the soil process consists generally of a single ploughing. The seed-time is in the month of May, but much depends on the state of the soil at the time of sowing. "It should neither be wet nor dry; and the surface ought to be made as fine as that of a garden bed. Not a clod of

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Linseed-
cake, lin-
seed itself,
and linseed
oil, used for
fattening
cattle.

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Culture of
flax in
Yorkshire.

the size of an egg should remain unbroken." Two bushels of seed are usually sown upon an acre: the surface, after being harrowed, is sometimes raked with garden or hay rakes; and the operation would be still more complete, if the clods and other obstructions, which cannot be easily removed, were drawn into the interfurrows. A light hand-roller used between the final raking and harrowing would much assist this operation. The chief requisite during the time of vegetation is weeding, which ought to be performed with the utmost care; and for this reason it is particularly requisite that the ground should be previously cleansed as well as possible, otherwise the expence of weeding becomes too great to be borne, or the crop must be considerably injured. It is an irreparable injury, if through a dry season, the plants come up in two crops; or if by accident or mismanagement they be too thin. The goodness of the crop depends on its running up with a single stalk without branches: for wherever it ramifies, there the length of the line terminates; and this ramification is the consequence of its having too much room at the root, or getting above the plants which surround it. The branches are never of any use, being unavoidably worked off in dressing; and the stem itself, unless it bear a due proportion to the length of the crop, is likewise worked off among the refuse. This ramification of the flax will readily be occasioned by clods on the ground when sown. A second crop is very seldom attended with any profit; for being overgrown with the spreading plants of the first crop, it remains weak and short, and at pulling time is left to rot upon the land.

Flax is injured not only by drought but by frost, and is sometimes attacked even when got five or six inches high, by a small white slug, which strips off the leaves to the top, and the stalks bending with their weight are thus sometimes drawn into the ground. Hence, if the crop does not promise fair at weeding time, our author advises not to bestow farther labour and expence upon it. A crop of turnips or rape will generally pay much better than such a crop of flax. The time of flax-harvest in Yorkshire is generally in the latter end of July or beginning of August.

On the whole, our author remarks, that "the goodness of the crop depends in some measure upon its length; and this upon its evenness and closeness upon the ground. Three feet high is a good length, and

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Mr Mar-
shall's re-
marks on
flax crops.
the

Flax and
Hemp.Flax and
Hemp.

the thickness of a crow's quill a good thickness. A fine stalk affords more line and fewer shivers than a thick one. A tall thick set crop is therefore desirable. But unless the land be good, a thick crop cannot attain a sufficient length of stem. Hence the folly of sowing flax on land which is unfit for it. Nevertheless, with a suitable soil, a sufficiency of seed evenly distributed, and a favourable season, flax may turn out a very profitable crop. The flax crop, however, has its disadvantages: it interferes with harvest, and is generally believed to be a great exhauster of the soil, especially when its seed is suffered to ripen. Its cultivation ought therefore to be confined to rich grass-land districts, where harvest is a secondary object, and where its exhaustion may be rather favourable than hurtful to succeeding arable crops, by checking the too great rankness of rich fresh broken ground.

468
Mr Bart-
ley's expe-
rience.

In the 5th volume of Bath Papers, Mr Bartley, near Bristol, gives an account of the expences and produce of five acres of flax cultivated on a rich loamy sand. The total expence was 42l. 13s. 4d.; the produce was ten packs of flax at 5l. 5s. value 52l. 10s. 35 bushels of linseed at 5s. value 8l. 15s.; the net profit therefore was 18l. 11s. 8d. or 4l. 13s. 4d. per acre. This gentleman is of opinion that flax-growers ought to make it their staple article, and consider the other parts of their farm as in subserviency to it.

469
Remarks
by a Dorset-
shire gen-
tleman.

In the second volume of Bath Papers, a Dorsetshire gentleman, who writes on the culture of hemp and flax, gives an account somewhat different from that of Mr Marshall. Instead of *exhausting* crops, he maintains that they are both *ameliorating* crops, if cut without seeding; and as the best crops of both are raised from foreign seed, he is of opinion that there is little occasion for raising it in this country. A crop of hemp, he informs us, prepares the land for flax, and is therefore clear gain to the farmer. "That these plants impoverish the soil," he repeats, "is a mere vulgar notion, devoid of all truth.—The best historical relations, and the verbal accounts of honest ingenious planters, concur in declaring it to be a vain prejudice, unsupported by any authority; and that these crops really meliorate and improve the soil." He is likewise of opinion, that the growth of flax and hemp is not necessarily confined to rich soils, but that they may be cultivated with profit also upon poor sandy ground, if a little expence be laid out in manuring it. "Spalding-moor in Lincolnshire is a barren sand; and yet with proper care and culture it produces the best hemp in England, and in large quantities. In the isle of Asholme, in the same county, equal quantities are produced; for the culture and management of it is the principal employ of the inhabitants; and, according to Leland, it was so in the reign of Henry VIII. In Marshland the soil is a clay or strong warp, thrown up by the river Ouse, and of such quality, that it cracks with the heat of the sun, till a hand may be put into the chinks; yet if it be once covered with the hemp or flax before the heats come on, the ground will not crack that summer. When the land is sandy, they first sow it with barley, and the following spring they manure the stubble with horse or cow dung, and plough it under. Then they sow their hemp or flax, and harrow it in with a light harrow, having short teeth. A good crop destroys all the weeds, and makes

470
Flax and
hemp may
be cultiva-
ted upon
poor as
well as rich
soils.

it a fine fallow for flax in the spring. As soon as the flax is pulled, they prepare the ground for wheat. Lime, marl, and the mud of ponds, is an excellent compost for hemp-lands."

Our author takes notice of the vast quantity of flax and hemp, not less than 11,000 tons, imported in the year 1763 into Britain; and complains that it is not raised in the island, which he thinks might be done, though it would require 62,000 acres for the purpose.

471
Vast quan-
tities of flax
and hemp
imported
into Bri-
tain.

He observes, that the greater part of those rich marshy lands lying to the west of Mendip hills are very proper for the cultivation of hemp and flax; and if laid out in this manner could not fail of turning out highly advantageous both to the landholders and the public at large. The vast quantities of hemp and flax (says he) which have been raised on lands of the same kind in Lincolnshire marshes, and the fens of the isle of Ely and Huntingdonshire, are a full proof of the truth of my assertion. Many hundreds of acres in the above-mentioned places, which, for pasturage or grazing, were not worth more than twenty or twenty-five shillings per acre, have been readily let at 4l. the first year, 3l. the second, and 2l. the third. The reason of this supposed declining value of land, in proportion to the number of years sown with flax, is, that it is usual with them to seed for the purpose of making oil, that being the principal cause of the land being thereby impoverished.

It is certain, however, that the quantity of hemp exported from St Petersburg in British ships has continued to increase, so that in 1785 the quantity of hemp exported from Petersburg in British ships was as follows:

	Poods.
Of clean hemp, - - -	1,038,791
Outshot, - - - -	37,382
Half clean, - - - -	18,374
Hemp codille, - - - -	19,251
	<hr/>
	1,113,798

There are 63 poods to a ton, consequently the whole amounted to 17,695 tons; and it is said that this quantity has since been tripled and quadrupled. It is therefore an object of great national importance to consider, whether flax and hemp might not be profitably reared in our own country without producing any alarm concerning their tendency to exhaust the soil. With this view we shall here state the substance of a report made by Mr Durno, British consul in Prussia in 1789, to the lords of the Committee of Council for Trade, concerning the method of cultivating flax and hemp in Prussia, Russia, and Poland.

A black, not morassy, open gravelly soil is preferred, as flax and hemp become exuberant and coarse on too rich a soil. To ascertain the proper middle degree of strength of soil, previous crops of grain are taken. On a vigorous soil wheat is first sown; then rye, barley, oats; and last of all flax or hemp. Two successive crops of hemp are taken if the land is intermediately dunged. For one crop of flax, it is not dunged at all. On a soil of less strength, flax and hemp are sown immediately after a winter crop of rye, the land being ploughed in autumn, if the weather allows, if not, in spring. It is then harrowed and manured, and again

472
Mr Durno's
report on
the culture
of flax and
hemp in
Prussia, &c.

Flax and
Hemp.

ploughed immediately before sowing. Another winter crop of rye may immediately be sown in the same field after drawing the flax or hemp, but after the flax; dung is in this case necessary. A field that has been laid down in fallow, if only ploughed up, yields a better crop of flax than if manured and cultivated in the above or any other way. Flax and hemp are sown from the 25th of May to the 10th of June, and the flax is reaped in the end of August, and hemp in the end of September.

As to their effects on the soil, no kind of grain can be sown immediately after a crop of flax without dunging, but after one of hemp, any grain, and even hemp itself, may be sown without manure. Hemp cleans the ground, by suffocating, by its broad leaves, all sorts of weeds or undergrowth; but flax must be weeded once or twice before it blooms. Flax is plucked when the stalk becomes yellowish, the pods brown, and the seed hard and full bodied. For finer flax, the stalk is pulled while yet green; but the seed is then sacrificed, and fit only for crushing for oil, of which it produces a small quantity. Hemp is also plucked or drawn when the stalk and pods have changed colour. If the flax is very dry when plucked, the seed is stripped off immediately; if not, it is allowed to dry on the field. The seed-pods are spread thinly on a floor, where they are turned twice a-day, till so dry that they open of themselves; when it is threshed and cleaned like other grain. To gain the hemp-seed, the hemp itself, when plucked, is set on end against any convenient place. The roots and top-ends are then cut off. The roots are thrown away, and the top-ends are threshed out and cleaned. The seed is apt to be spoiled by remaining in a moist state for any length of time.

As soon as the seed has been gained, the flax and hemp are steeped in water till the flax separate from the rind, and the hemp till the harl springs from the stalk. In soft water, in warm weather, nine or ten days are sufficient for this purpose. In hard water, with cold weather, from fourteen days to three weeks are requisite. Stagnate is preferred to running water; but fish ponds and the drinking places of cattle must be avoided, as the fish would be destroyed, and the water would be rendered unwholesome and unpalatable to the cattle; but a muddy or slimy bottom is preferred. In the southern provinces of Poland, as Volhinia, Podolia, &c. steeping is not practised, on the supposition that it weakens the harl and darkens the colour, though this idea seems to have no foundation.

After being taken out of the steep, the flax is dried on a grass field; after which it is gathered up into small stacks; but the hemp, instead of being spread out on a field, is set up against the walls of buildings till it is also dried, after which they are both housed.

It is generally understood in these countries, that the cultivation of flax and hemp is more profitable than that of any kind of grain.

473
Culture of
flax in Ire-
land.

To this we shall add a concise statement of the mode of cultivating flax in Ireland. A good crop of flax is there expected from any strong clays that are fit for the growth of corn; but an open black loamy soil, enriched by having lain long in pasture, is preferable. The ground must be in fine tilth, and as free from weeds as possible. Potatoes usually precede flax, though

turnips, beans, or any manured crop, are a good preparation: but the first or second crop after pasture is preferred to any of these. Stubble lands, that have been long in tillage, may, by proper preparation, bring a crop; but it is apt to fail in such situations, the stalks turning to a reddish colour called *firing* before it ripens; upon which it must immediately be pulled. Two bushels of seed are used to the English acre, unless for the purpose of a very fine manufacture; in which case a large quantity of seed is used, and the flax is pulled very green. The season of sowing is the first fine weather after the middle of March. The most approved mode of culture is in beds about six feet broad, covering the seed about an inch and a half deep, with earth shovelled out of the furrows: but the most ordinary mode is to sow on common ridges, and to harrow in the seed. Before the flax is five inches high it should be carefully hand-weeded; and if any part lodges, it should be turned over. The produce is usually worth 7l. sterling the English acre. The crop should stand till the lower part of the stalk becomes yellowish, and the under leaves begin to wither, unless the seed is to be preserved, which is done by rippling it through an iron comb, and the flax may be steeped immediately after it is pulled. Turf-bog water, if clear, answers well, but foul stagnate water stains the flax. Too pure a spring is injurious. A reservoir dug in clay is preferred. The time of lying in the steep depends upon the quality of the water and the state of the weather. It is dried on grass by being spread thin; artificial heat has been recommended for drying flax; but no good form of it has been suggested.

Rape or
Cole-Seed.

In addition to what is here stated, the compiler of this article accounts it proper to take notice of a mode of weeding flax that has frequently been practised in Scotland. It consists of turning a flock of sheep at large into the field. They will not taste the young flax plants, but they carefully search for the weeds, which they devour. It may also be remarked, that for drying flax in wet seasons, the steam kiln formerly proposed (N^o 34.) would be a valuable instrument.

474
of Sheep em-
ployed to
weed flax.

SECT. II. Rape or Cole-Seed.

THIS, as well as linseed, is cultivated for the purpose of making oil, and will grow almost anywhere. Mr Hazard informs us, that in the north of England the farmers pare and burn their pasture lands, and then sow them with rape after one ploughing; the crop commonly standing for seed, which will bring from 25l. to 30l. per last (80 bushels). Poor clay, or stone-brash land, will frequently produce from 12 to 16 or 18 bushels per acre, and almost any fresh or virgin earth will yield one plentiful crop; so that many in the northern counties have been raised, by cultivating this seed, from poverty to the greatest affluence. The seed is ripe in July or the beginning of August; and the threshing of it out is conducted with the greatest mirth and jollity.

475
Advantage
of cultivat-
ing rape-
seed.

The rape being fully ripe, is first cut with sickles, and then laid thin upon the ground to dry; and when in proper condition for threshing, the neighbours are invited, who readily contribute their assistance. The threshing is performed on a large cloth in the middle

476
Of cutting
and thresh-
ing the
rape-seed.

Rape or Cole-Seed. of the field, and the seed put into the sacks and carried home. It does not admit of being carried from the field in the pod in order to be threshed at home, and therefore the operation is always performed in the field; and by the number of assistants procured on this occasion, a field of 20 acres is frequently threshed out in one day. The straw is burnt for the sake of its alkali, the ashes being said to equal the best kind of those imported from abroad.

477 of sowing. The proper time of sowing rape is the month of June; and the land should, previous to the sowing, be twice well ploughed. About two pounds of seed are sufficient for an acre; and, according to our author, it should be cast upon the ground with only the thumb and two fore fingers; for if it be cast with all the fingers, it will come up in patches. If the plants come up too thick, a pair of light harrows should be drawn along the field length-wise and cross-wise; by which means the plants will be equally thinned; and when the plants which the harrows have pulled up are withered, the ground should be rolled. A few days after the plants may be set out with a hoe, allowing 16 or 18 inches distance betwixt every two plants.

478 trans-planting recommended. Mr Hazard strongly recommends the transplanting of rape, having experienced the good effects of it himself. A rood of ground, sown in June, will produce as many plants as are sufficient for 10 acres; which may be planted out upon ground that has previously borne a crop of wheat, provided the wheat be harvested by the middle of August. One ploughing will be sufficient for these plants; the best of which should be selected from the seed-plot, and planted in rows two feet asunder and 16 inches apart in the rows. As rape is an excellent food for sheep, they may be allowed to feed upon it in the spring; or the leaves might be gathered, and given to oxen or young cattle: fresh leaves would sprout again from the same stalks, which in like manner might be fed off by ewes and lambs in time enough to plough the land for a crop of barley and oats. Planting rape in the beginning of July, however, would be most advantageous for the crop itself, as the leaves might then be fed off in the autumn, and new ones would appear in the spring. Our author discommends the practice of sowing rape with turnips, as the crops injure one another. "Those who look for an immediate profit (says he), will undoubtedly cultivate rape for seed; but perhaps it may answer better in the end to feed it with sheep; the fat ones might cull it over first, and afterwards the lean or store-sheep might follow them, and he folded thereon; if this is done in the autumn season, the land will be in good heart to carry a crop of wheat; or where the rape is fed off in the spring, a crop of barley might follow. In either case rape is profitable to the cultivator; and when it is planted, and well earthed round the stems, it will endure the severest winter; but the same cannot be advanced in favour of that which is sown broadcast.

430 Culture of Cole-seed in Brabant. Cole-seed is cultivated in Brabant, in the following manner, according to the Abbé Mann. "It is sown about the middle of July, and the young plants are transplanted about the end of September. This is done with a narrow spade sunk into the ground, and moved with the hand forwards and backwards; which simple motion, makes a sufficient opening to receive the plant;

a boy or girl follows the labourer with plants, and putting one of them into each hole, treads against it to close it up. If the plantation is done with the plough, the plants are placed at regular distances in the furrow, and are covered with the earth turned up with the succeeding furrow. Sometimes, after the cole-seed is planted, the foot of the stalks is covered, by means of a common spade or hoe, with the earth near it, which furnishes nourishment for the plants during winter, by the crumbling of these little clods of earth over the roots. The cole seed is reaped about midsummer or latter, according as the season is more or less advanced; it is left on the field for ten or twelve days after it is cut, and then threshed on a kind of sail-cloth, spread on the ground for that purpose, and the seed carried in sacks to the farm. When the crop is good, a bunder produces about forty raziers of 80lbs. weight each. It is to be observed, that the ground whereon cole-seed is to be planted, must be dunged and twice ploughed the same year it is put in use."

SECT. III. Coriander-Seed.

THIS is used in large quantities by distillers, druggists, and confectioners, and might be a considerable object to such farmers as live in the neighbourhood of great towns; but the price is very variable, viz. from 16s. to 42s. per cwt. In the 4th volume of Bath Papers, Mr Bartley gives an account of an experiment 481 Mr Bartley's experiment. made on this seed, which proved very successful. Ten perches of good sandy loam were sown with coriander on the 23d of March 1783. Three pounds of seed were sufficient for this spot; and the whole expence amounted only to 5s. 10d. The produce was 87 pounds of seed, which, valued at 3d. yielded a profit of 5s. 11d. or 15l. 18s. 4d. per acre. He afterwards made several other experiments on a larger scale; but none of the crops turned out so well, though all of them afforded a good profit.

SECT. IV. Canary-Seed.

THIS is cultivated in a large quantity in the Isle of Thanet, where it is said they have frequently 20 bushels to an acre. Mr Bartley, in the month of March 1783, sowed half an acre of ground, the soil a mixture of loam and clay, but had only eight bushels and a half, or 17 bushels per acre. With this produce, however, he had a profit of 4l. 2s. 3d. per acre. 482 Culture of canary-seed.

SECT. V. Woad.

THE use of this in dyeing is well known, and the consumption is so great, that the raising of the plant 483 Woad easily cultivated. might undoubtedly be an object to a husbandman, provided he could get it properly manufactured for the dyers, and could overcome their prejudices. At present, the growing of this plant is in a manner monopolized by some people in particular places, particularly at Keynsham near Bristol in England. Mr Bartley informs us, that in a conversation he had with these growers, the latter asserted, that the growth of woad was peculiar to their soil and situation. The soil about this place is a blackish heavy mould, with a considerable proportion of clay, but works freely: that of
Brislington,

Hops.

Brislington, where Mr Bartley resides, a hazel sandy loam; nevertheless, having sowed half an acre of this soil with woad-seed, it throve so well, that he never saw a better crop at Keynsham. Having no apparatus, however, or knowledge of the manufacture, he suffered it to run to seed, learning only from the experiment, that woad is very easily cultivated, and that the only difficulty is the preparing it for the market.

SECT. VI. Hops.

484
Hops for-
bid by act
of parlia-
ment.

THE uses of these as an ingredient in malt liquors, are well known. Formerly, however, they were supposed to possess such deleterious qualities, that the use of them was forbid by act of parliament in the reign of James VI. But though this act was never repealed, it does not appear that much regard was ever paid to it, as the use of hops has still continued, and is found not to be attended with any bad effects on the human constitution. The only question, therefore, is, How far the raising a crop of them may be profitable to a husbandman? and indeed this seems to be very doubtful.

* *Annals of*
Kent and Essex,
vol. ii.
485
Expence of
cultivating
them at
Castle Hed-
ingham.

Mr Arthur Young, in a Fortnight's Tour through Kent and Essex, informs us*, that at Castle Hedingham he was told by Mr Rogers, who had a considerable hop-plantation, that four acres of hop-ground cost him upwards of 120*l.* and that the usual expences of laying out an acre of ground in this way amounted to 34*l.* 6*s.* By a calculation of the expences of an acre in Kent, it appeared that the money sunk to plant an acre there amounted to 32*l.* 8*s.* 6*d.*; that the annual expence was 23*l.* and the profit no more than 11*l.* 8*s.* 1*d.* In another place, he was informed by a Mr Potter, who cultivated great quantities of hops, that if it were not for some extraordinary crops which occurred now and then, nobody would plant them. In Essex, the expences of a hop-plantation are still greater than those we have yet mentioned; an acre many years ago requiring 75*l.* to lay it out on hops, and now not less than 100*l.*; the annual expence being estimated at 31*l.* 1*s.* while the produce commonly does not exceed 32*l.*

486
In Essex.

In the neighbourhood of Stow-market in this county, Mr Young informs us, there are about 200 acres planted with hops, but "18 or 20 are grubbed up within two years, owing to the badness of the times." Here they are planted on a black loose moor, very wet and boggy; and the more wet the better for the crop, especially if the gravel which constitutes the bottom, be not more than three feet from the surface. In preparing the ground for hops, it is formed into beds, 16 feet wide, separated from each other by trenches. In these beds they make holes six feet asunder, and about 12 inches diameter, three rows upon a bed. In each hole they put about half a peck of very rotten dung or rich compost; scatter earth upon it, and plant seven sets in each; drawing earth enough to them afterwards to form something of a hillock. A hop-garden, Mr Young informs us, "will last almost for ever, by renewing the hills that fail, to the amount of about a score annually, but it is reckoned better to grub up and new-plant it every 20 or 25 years."

In this volume of the Annals, Mr Young informs us, that "one profit of hop-land is that of breaking it up. Mr Potter grubbed up one garden, which failing, he ploughed and sowed barley, the crop great; then mazagan beans, two acres of which produced 16 quarters and five bushels. He then sowed it with wheat, which produced 13 quarters and four bushels and a half: but since that time the crops have not been greater than common. The same gentleman has had 10 quarters of oats after wheat." In the ninth volume of the same work, however, we have an account of an experiment by Mr Le Bland of Sittingbourn in Kent, of grubbing up 12 acres of hop-ground, which was not attended with any remarkable success. Part of the hops were grubbed up in the year 1781, and mazagan beans sown in their stead: but by reason of the seed being bad, and the dry summer, the crop turned out very indifferent. Next year the remainder of the hops were grubbed up, and the whole 12 acres sown with wheat; but still the crop turned out very bad, owing to the wet summer of that year. It was next planted with potatoes, which turned out well: and ever since that time the crops have been good. This gentleman informs us, that the person who had the hop-ground above mentioned did not lose less by it than 1500*l.*

The culture of hops seems to be confined in a great measure to the southern counties of England; for Mr Marshall mentions it as a matter of surprise, that in Norfolk he saw a "tolerably large hop-garden." The proprietor informed him, that three or four years before there had been 10 acres of hops in the parish (Blowfield) where he resided; which was more than could be collected in all the rest of the county; but at that time there were not above five; and the culture was daily declining, as the crops, owing to the low price of the commodity, did not defray the expence.

From all this it appears, that hops are perhaps the most uncertain and precarious crop on which the husbandman can bestow his labour. Mr Young is of opinion, that some improvement in the culture is necessary; but he does not mention any, excepting that of planting them in espaliers. This method was recommended both by Mr Rogers and Mr Potter above mentioned. The former took the hint from observing, that a plant which had been blown down, and afterwards shot out horizontally, always produced a greater quantity than those which grew upright. He also remarks, that hops which are late picked carry more next year than such as are picked early; for which reason he recommends the late picking. The only reason for picking early is, that the hops appear much more beautiful than the others.

SECT. VII. Cultivation of Fruit.

In Herefordshire and Gloucestershire the cultivation of fruit for the purpose of making a liquor from the juice, forms a principal part of their husbandry. In Devonshire also considerable quantities of this kind of liquor are made, though much less than in the two counties above mentioned.

The fruits cultivated in Herefordshire and Gloucestershire are, the apple, the pear, and the cherry. From the two first are made the liquors named *cyder* and *per-ry*; shire.

487
Profit of
breaking
up hop-
land prece-
rious.

488
Culture of
hops in
Norfolk on
the declin-

489
Fruits cul-
tivated in
Hereford-
shire and
per-Gloucest-

cultivation of Fruits; but though it is probable that a liquor of some value might be made from cherries also, it does not appear to have ever been attempted. Mr Marshall remarks, that nature has furnished only one species of pears and apples, viz. the common crab of the woods and hedges, and the wild pear, which is likewise pretty common. The varieties of these fruits are entirely artificial, being produced not by seed, but by a certain mode of culture; whence it is the business of those who wish to improve fruit, therefore, to catch at superior accidental varieties; and having raised them by cultivation to the highest perfection of which they are capable, to keep them in that state by artificial propagation. Mr Marshall, however, observes that it is impossible to make varieties of fruit altogether permanent, though their duration depends much upon management. "A time arrives (says he) when they can no longer be propagated with success. All the old fruits which raised the fame of the liquors of this country are now lost, or so far on the decline as to be deemed irrecoverable. The *red streak* is given up; the celebrated *stir-apple* is going off; and the *squash-pear*, which has probably furnished this country with more *champaign* than was ever imported into it, can no longer be got to flourish: the stocks canker, and are unproductive. In Yorkshire similar circumstances have taken place: several old fruits which were productive within my own recollection are lost; the stocks cankered, and the trees would no longer come to bear."

Our author controverts the common notion among orchard-men, that the decline of the old fruits is owing to a want of fresh grafts from abroad, particularly from Normandy, from whence it is supposed that apples were originally imported into this country. Mr Marshall, however, thinks, that these original kinds have been long since lost, and that the numerous varieties of which we are now possessed were raised from seed in this country. He also informs us, that at Ledbury he was shown a Normandy apple tree, which, with many others of the same kind, had been imported immediately from France. He found it, however, to be no other than the *bitter-sweet*, which he had seen growing as a neglected wilding in an English hedge.

The process of raising new varieties of apples, according to Mr Marshall, is simple and easy. "Select (says he) among the native species individuals of the highest flavour; sow the seeds in a highly enriched seed-bed. When new varieties, or the improvement of old ones, are the objects, it may perhaps be eligible to use a frame or stove; but where the preservation of the ordinary varieties only is wanted, an ordinary loamy soil will be sufficient. At any rate, it ought to be perfectly clean at least from root weeds, and should be double dug from a foot to 18 inches deep. The surface being levelled and raked fine, the seeds ought to be scattered on about an inch asunder, and covered about half an inch deep with some of the finest mould previously raked off the hed for that purpose. During summer the young plants should be kept perfectly free from weeds, and may be taken up for transplantation the ensuing winter; or if not very thick in the seed-bed, they may remain in it till the second winter,

The nursery ground ought also to be enriched, and double dug to the depth of 14 inches at least; though 18 or 20 are preferable. The seedling plants ought to

be sorted agreeably to the strength of their roots, that they may rise evenly together. The tap or downward roots should be taken off, and the longer side rootlets shortened. The young trees should then be planted in rows three feet asunder, and from 15 to 18 inches distant in the rows; taking care not to cramp the roots, but to lead them evenly and horizontally among the mould. If they be intended merely for stocks to be grafted, they may remain in this situation until they be large enough to be planted out; though, in strict management, they ought to be re-transplanted two years before their being transferred into the orchard, "in fresh but unmanured double-dug ground, a quincunx four feet apart every way." In this second transplantation, as well as in the first, the branches of the root ought not to be left too long, but to be shortened in such a manner as to induce them to form a globular root, sufficiently small to be removed with the plant; yet sufficiently large to give it firmness and vigour in the plantation.

Having proceeded in this manner with the seed-bed, our author gives the following directions: "Select from among the seedlings the plants whose wood and leaves wear the most *apple-like* appearance. Transplant these into a rich deep soil in a genial situation, letting them remain in this nursery until they begin to bear. With the seeds of the fairest, richest, and best-flavoured fruit repeat this process; and at the same time, or in due season, engraft the wood which produced this fruit on that of the richest, sweetest, best-flavoured apple; repeating this operation, and transferring the subject under improvement from one tree and sort to another, as richness, flavour, or firmness, may require; continuing this double mode of improvement until the desired fruit be obtained. There has no doubt been a period when the improvement of the apple and pear was attended to in this country; and should not the same spirit of improvement revive, it is probable that the country will, in a course of years, be left destitute of valuable kinds of these two species of fruit; which, though they may in some degree be deemed objects of luxury, long custom seems to have ranked among the necessaries of life."

In the fourth volume of Bath Papers, Mr Grimwood supposes the degeneracy of apples to be rather imaginary than real. He says, that the evil complained of "is not a real decline in the quality of the fruit, but in the tree; owing either to want of health, the season, soil, mode of planting, or the stock they are grafted on being too often raised from the seed of apples in the same place or country. I have not a doubt in my own mind, but that the trees which are grafted on the stocks raised from the apple pips are more tender than those grafted on the real crab-stock; and the seasons in this country have, for many years past, been unfavourable for fruits, which add much to the supposed degeneracy of the apple. It is my opinion, that if the planters of orchards would procure the trees grafted on real crab-stocks from a distant country, they would find their account in so doing much overbalance the extra expence of charge and carriage.

In the same volume, Mr Edmund Gillingwater signs as a reason for the degeneracy of apples, the mixture of various farina, from the orchards being too near each other. In consequence of this notion,

Cultivation of Fruit.

Method of choosing the plants.

Mr Grimwood's opinion of the degeneracy of apples.

Mr Gillingwater's opinion.

Cultivation
of Fruit.

he also thinks that the old and best kinds of apple trees are not lost, but only corrupted from being planted too near bad neighbours: "Remove them (says he) to a situation where they are not exposed to this inconvenience, and they will immediately recover their former excellency." This theory, however, is not supported by a single experiment.

497
Mr Samuel's opinion of the method of recovering the best fruit.

In this volume also Mr Richard Samuel expresses his concern at the "present neglect of orchards, where the old trees are decaying, without proper provision being made for the succeeding age: for if a farmer plants fresh trees (which does not frequently happen), there is seldom any care taken to propagate the better sorts, as his grafts are usually taken promiscuously from any ordinary kind, most easily procured in the neighbourhood." His remedy is to collect grafts from the best trees; by which means he supposes that the superior kinds of fruit would soon be recovered. To a care of this kind he attributes the superiority of the fruit in the neighbourhood of great towns to that in other places.

498
Cultivation, &c. of fruit trees.

With regard to the method of cultivating fruit trees, it is only necessary to add, that while they remain in the nursery, the intervals between them may be occupied by such kitchen-stuff as will not crowd or overshadow the plants; keeping the rows in the mean time perfectly free from weeds. In pruning them, the leader should be particularly attended to. If they shoot double, the weaker of the contending branches should be taken off; but if the leader be lost, and not easily recoverable, the plant should be cut down to within a hand's breadth of the soil, and a fresh stem trained. The undermost boughs should be taken off by degrees, going over the plants every winter; but taking care to preserve heads of sufficient magnitude not to draw the stems up too tall, which would make them feeble in the lower part. The stems in Herefordshire are trained to six feet high; but our author prefers seven, or even half a rod in height. A tall-stemmed tree is much less injurious to what grows below it than a low-headed one, which is itself in danger of being hurt, at the same time that it hurts the crop under it. The thickness of the stem ought to be in proportion to its height; for which reason a tall stock ought to remain longer in the nursery than a low one. The usual size at which they are planted out in Herefordshire is from four to six inches girt at three feet high; which size, with proper management, they will reach in seven or eight years. The price of these stocks in Herefordshire is 1s. 6d. each. Our author met with one instance of crabstocks being gathered in the woods with a good prospect of success.

499
Method of managing the ground of orchards in Herefordshire and Gloucestershire.

In Herefordshire it is common to have the ground of the orchards in tillage, and in Gloucestershire in grass; which Mr Marshall supposes to be owing to the difference betwixt the soil of the two counties; that of Herefordshire being generally arable, and Gloucester grass land. Trees, however, are very destructive, not only to a crop of corn, but to clover and turnips; though tillage is favourable to fruit trees, in general, especially when young. In grass grounds their progress is comparatively slow, for want of the earth being stirred about them, and by being injured by the cattle, especially when low-headed and drooping. After they begin to bear, cattle ought by all means to be kept

away from them, as they not only destroy all the fruit within their reach, but the fruit itself is dangerous to the cattle, being apt to stick in their throats and choke them. These inconveniences may be avoided, by eating the fruit grounds bare before the gathering season, and keeping the boughs out of the way of the cattle: but Mr Marshall is of opinion, that it is wrong to plant orchards in grass land. "Let them (says he) lay their old orchards to grass; and if they plant, break up their young orchards to arable. This will be changing the course of husbandry, and be at once beneficial to the land and the trees.

Cultivation
of Fruit.

Our author complains very much of the indolent and careless method in which the Herefordshire and Gloucestershire farmers manage their orchards. The natural enemies of fruit trees (he says) are, 1. A redundancy of wood. 2. The misletoe. 3. Moss. 4. Spring of frosts. 5. Blights. 6. Insects. 7. An excess of fruit. 8. Old age.

500
Indolence of the farmers in these parts complained

1. A redundancy of wood is prejudicial, by reason of the barren branches depriving those which bear fruit of the nourishment which ought to belong to them. A multitude of branches also give the wind such an additional power over the tree, that it is in perpetual danger of being overthrown by them: trees are likewise thus injured by the damps and want of circulation of air, so that only the outer branches are capable of bringing fruit to maturity. "It is no uncommon sight (says he) to see trees in this district, with two or three tires of boughs pressing down hard upon one another, with their twigs so intimately interwoven, that even when the leaves are off, a small bird can scarcely creep in among them.

501
Excess of wood how remedied.

2. The misletoe in this country is a great enemy to the apple tree. It is easily pulled out with hooks in frosty weather, when, being brittle, it readily breaks off from the branches. It likewise may be applied to a profitable purpose, sheep being as fond of it as of ivy.

502
Mistletoe how destroyed.

3. Moss can only be got the better of by industry in clearing the trees of it; and in Kent there are people who make it their profession to do so.

503
Moss of fruit trees.

4. Spring-frosts, especially when they suddenly succeed rain, are great enemies to fruit trees; dry frosts only keep back the blossoms for some time. Art can give no farther assistance in this case than to keep the trees in a healthy and vigorous state, so as to enable them to throw out a strength of bud and blossom; and by keeping them thin of wood, to give them an opportunity of drying quickly before the frost set in.

504
Spring-frosts.

5. Blight is a term, as applied to fruit trees, which Mr Marshall thinks is not understood. Two bearing years, he remarks, seldom come together; and he is of opinion, that it is the mere exhausting of the trees by the quantity of fruit which they have carried one year, that prevents them from bearing any the next. The only thing, therefore, that can be done in this case is, to keep the trees in as healthy and vigorous a state as possible.

505
Blights as uncertain term.

6. Insects destroy not only the blossoms and leaves, but some of them also the fruit, especially pears. In the year 1783 much fruit was destroyed by wasps. Mr Marshall advises to set a price upon the female wasps in the spring; by which these mischievous insects would perhaps be exterminated, or at least greatly lessened.

506
Method of destroying wasps.

Timber Trees. 7. An excess of fruit stunts the growth of young trees, and renders all in general barren for two or three years; while in many cases the branches are broken off by the weight of the fruit; and in one case Mr Marshall mentions, that an entire tree had sunk under its burden. To prevent as much as possible the bad effects of an excess of fruit, Mr Marshall recommends "to graft in the boughs," and when fully grown, to thin the bearing branches; thus endeavouring, like the gardener, to grow fruit every year."

507 of an excess of fruit. 508 Duration of fruit trees may be lengthened. 8. Though it is impossible to prevent the effects of old age, yet by proper management the natural life of fruit trees may be considerably protracted. The most eligible method is to graft stocks of the native crab in the boughs. The decline of the tree is preceded by a gradual decline of fruitfulness, which takes place long before the tree manifests any sign of decay. During this decline of fruitfulness, there is a certain period when the produce of a tree will no longer pay for the ground it occupies; and beyond this period it ought by no means to be allowed to stand. In the Vale of Gloucester, however, our author saw an instance of some healthy bearing apple trees, which then had the second tops to the same stems. The former tops having been worn out, were cut off, and the stumps saw-grafted. Our author observes, that the pear tree is much longer lived than the apple, and ought never to be planted in the same ground. He concludes with the following general observation: "Thus considering fruit trees as a crop in husbandry, the general management appears to be this: Plant upon a recently broken-up worn-out sward. Keep the soil under a state of arable management, until the trees be well grown: then lay it down to grass, and let it remain in sward until the trees be removed, and their roots be decayed; when it will again require a course of arable management."

SECT. VIII. *Of Timber Trees.*

509 Mr Marshall's observation on the culture of fruit trees. THE importance and value of these are so well known that it is superfluous to say any thing on that subject at present: notwithstanding this acknowledged value, however, the growth of timber is so slow, and the returns for planting so distant, that it is generally supposed for a long time to be a positive loss, or at least to be attended with no profit. This matter, however, when properly considered, will appear in another light. There are four distinct species of woodlands; viz. woods, timber groves, coppices, and woody wastes. The woods are a collection of timber trees and underwood; the timber groves contain timber trees without any underwood; and the coppices are collections of underwood alone. All these turn out to advantage sooner or later, according to the quick or slow growth of the trees, and the situation of the place with respect to certain local advantages. Thus in some places underwood is of great consequence, as for rails, hoops, stakes, fuel, &c.; and by reason of the quickness of its growth it may be accounted the most profitable of all plantations. An osier-bed will yield a return of profit the second or third year, and a coppice in 15 or 20 years; while a plantation of oaks will not arrive at perfection in less than a century. This last period is so long, that it may not unreasonably be supposed

likely to deter people from making plantations of this kind, as few are willing to take any trouble for what they are never to see in perfection. It must be remembered, however, that though the trees themselves do not come to perfection in a shorter time, the value of the ground will always increase in proportion to their age. Thus, says one author upon this subject, "we have some knowledge of a gentleman now living, who during his lifetime has made plantations, which in all probability will be worth to his son as much as his whole estate, handsome as it is. Supposing that those plantations have been made 50 or 60 years, and that in the course of 20 or 30 more they will be worth 50,000l.; may we not say, that at present they are worth some 20,000l. or 30,000l.?" Mr Pavier, in the 4th volume of Bath Papers, computes the value of 50 acres of oak timber in 100 years to be 12,100l. which is nearly 50s. annually per acre: and if we consider that this is continually accumulating, without any of that expence or risk to which annual crops are subject, it is probable that timber planting may be accounted one of the most profitable articles in husbandry. Evelyn calculates the profit of 1000 acres of oak land, in 150 years, at no less than 670,000l.; but this is most probably an exaggeration. At any rate, however, it would be improper to occupy, especially with timber of such slow growth, the grounds which either in grass or corn can repay the trouble of cultivation with a good annual crop.

510 Different kinds of woodlands. 511 What plantation willonesting in a turn of oft. In the fourth volume of the Bath Papers, Mr Wagstaffe recommends planting as an auxiliary to cultivation. He brings an instance of the success of Sir William Jerringham, who made trial of "the most unpromising ground perhaps that any successful planter has hitherto attempted." His method was to plant beech trees at proper distances among Scotch firs, upon otherwise barren heaths. "These trees (says Mr Wagstaffe), in a soil perhaps without clay or loam, with the heathy sod trenched into its broken strata of sand or gravel, under the protection of the firs, have laid hold, though slowly, of the soil; and accelerated by the superior growth of the firs, have proportionally risen, until they wanted an enlargement of space for growth, when the firs were cut down." He next proceeds to observe, that when the firs are felled, their roots decay in the ground; and thus furnish by that decay a new support to the soil on which the beeches grow: by which means the latter receive an additional vigour, as well as an enlargement of space and freer air; the firs themselves, though cut down before they arrived at their full growth, being also applicable to many valuable purposes.

512 Advantages of planting. 513 Planting meliorates the soil. In the sixth volume of Annals of Agriculture, we find the culture of trees recommended by Mr Harries; and he informs us, that the larch is the quickest grower and the most valuable of all the resinous timber trees; but unless there be pretty good room allowed for the branches to stretch out on the lower part of the trunk, it will not arrive at any considerable size; and this observation, he says, holds good of all pyramidal trees. Scotch firs may be planted between them, and pulled out after they begin to obstruct the growth of the larch. Some of these larches he had seen planted about 30 years before, which, at 5 feet distance from the ground, measured from 4 feet to 5 feet 6 inches in circumference.

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ence. The most barren grounds, he says, would answer for these trees, but better soil is required for the oaks. In this paper he takes notice of the leaves of one of his plantations of oaks having been almost entirely destroyed by insects; in consequence of which they did not increase in bulk as usual: but another which had nearly escaped these ravages, increased at an average 1 inch in circumference. "A tree 4 feet round (says he), that has timber 20 feet in length, gains by this growth a solid foot of timber annually, worth one shilling at least, and pays 5 per cent. for standing. It increases more as the tree gets from 5 to 6 feet round. I have a reasonable hope to infer from my inquiry, that I have in my groves 3000 oaks that pay me one shilling each per annum, or 150l. a-year. My poplars have gained in circumference near two inches, and a Worcester and witch elm as much. I have lately been informed, that the smooth cut of a holly tree, that measures 20 inches and upwards round, is worth to the cabinet-makers 2s. 6d. per foot.

515
Increase of
oak trees.516
Increase of
trees in the
marquis
of Lans-
downe's
plantation.

The following table shows the increase of trees in 21 years from their first planting. It was taken from the marquis of Lansdowne's plantation, begun in the year 1765, and the calculation made on the 15th of July 1786. It is about six acres in extent; the soil partly a swampy meadow upon a gravelly bottom. The measures were taken at 5 feet above the surface of the ground; the small firs having been occasionally drawn for posts and rails, as well as rafters for cottages; and when peeled of the bark, will stand well for seven years.

	Height in Feet.	Circumference in Feet. Inch.	
Lombardy poplar	- 60 to 80	4	8
Arbeal	- 50 to 70	4	6
Plane	- 50 to 60	3	6
Acacia	- 50 to 60	2	4
Elm	- 40 to 60	3	6
Chesnut	- 30 to 50	2	9
Weymouth pines	- 30 to 50	2	5
Cluster ditto	- 30 to 50	2	5
Scotch fir	- 30 to 50	2	10
Spruce ditto	- 30 to 50	2	2
Larch	- 50 to 60	3	10

From this table it appears, that planting of timber-trees, where the return can be waited for during the space of 20 years, will undoubtedly repay the original profits of planting, as well as the interest of the money laid out; which is the better worth the attention of a proprietor of land, as the ground on which they grow may be supposed good for very little else. From a comparative table of the growth of oak, ash, and elm timber, given in the 11th volume of the Annals of Agriculture, it appears that the oak is by much the slowest grower of the three.

517
Of under-
wood, &c.

With respect to the growth of underwood, which in some cases is very valuable, it is to be remarked, that in order to have an annual fall of it, the whole quantity of ground, whatever its extent may be, ought to be divided into annual sowings. The exact number of sowings must be regulated by the uses to which it is intended to be put. Thus if, as in Surry, stakes, edders, and hoops are saleable, there ought to be eight or ten annual sowings; or if, as in Kent, hop-

poles are demanded, 14 or 15 will be required; and if, as in Yorkshire, rails be wanted, or, as in Gloucestershire, cordwood be most marketable, 18 or 20 sowings will be necessary to produce a succession of annual falls. Thus the business, by being divided, will be rendered less burdensome: a certain proportion being every year to be done, a regular set of hands will, in proper season, be employed; and by beginning upon a small scale, the errors of the first year will be corrected in the practice of the second, and those of the second in that of the third. The produce of the intervals will fall into regular course; and when the whole is completed, the falls will follow each other in regular succession. The greatest objection to this method of sowing woodlands is the extraordinary trouble in fencing: but this objection does not hold if the sowings lie at a distance from one another; on the contrary, if they lie together, or in plots, the entire plot may be inclosed at once; and if it contain a number of sowings, some subdivisions will be necessary, and the annual sowings of these subdivisions may be fenced off with hurdles, or some other temporary contrivance; but if the adjoining land be kept under the plough, little temporary fencing will be necessary. It must be observed, however, that in raising a woodland from seeds, it is not only necessary to defend the young plants against cattle and sheep, but against hares and rabbits also: so that a close fence of some kind is absolutely necessary.

With regard to the preparation of the ground for raising timber, it may be observed, that if the soil be of a stiff clayey nature, it should receive a whole year's fallow as for wheat; if light, a crop of turnips may be taken; but at all events it must be made perfectly clean before the tree seeds be sown, particularly from perennial root weeds; as, after the seeds are sown, the opportunity of performing this necessary business is in a great measure lost. If the situation be moist, the soil should be gathered into wide lands, sufficiently round to let the water run off from the surface, but not high. The time of sowing is either the month of October or March; and the method as follows: "The land being in fine order, and the season favourable, the whole should be sown with corn or pulse adapted to the season of sowing: if in autumn, wheat or rye may be the crop; but if in spring, beans or oats. Which-

518
Method of
sowing.

ever of these three species be adopted, the quantity of seed ought to be less than usual, in order to give a free admission of air, and prevent the crop from loading. The sowing of the grain being completed, that of the tree-seeds must be immediately set about. These are to be put in drills across the land: acorns and nuts should be dibbled in, but keys and berries scattered in trenches or drills drawn with the corner of a hoe, in the manner that gardeners sow their pease. The distance might be a quarter of a statute rod, or four feet and one inch and a half. A land-chain should be used in setting out the drills, as not being liable to be lengthened or shortened by the weather. It is readily divided into rods; and the quarters may be easily marked.

The species of underwood to be sown must be determined by the consumpt of it in the neighbourhood of the plantation. Thus, if stakes, hoops, &c. be in request, the oak, hazel, and ash, are esteemed

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as underwood. Where charcoal is wanted for iron forges, beech is the prevailing underwood. The oak, box, birch, &c. are all in request in different countries, and the choice must be determined by the prevailing demand. As the keys of the ash sometimes lie two or even three years in the ground, it will be proper to have the places where they are sown distinguished by some particular marks, to prevent them from being disturbed by the plough after harvest: as a few beans scattered along with them, if the crop be oats; or oats, if the crop be beans. The crop should be *reaped*, not *mown*, at harvest time, and be carried off as fast as possible. Between harvest and winter, a pair of furrows should be laid back to back in the middle of each interval, for meliorating the next year's crop, and laying the seedling plants dry; while the stubble of the unploughed ground on each side of the drills will keep them warm during the winter. The next year's crop may be potatoes, cabbages, turnips, or if the first was corn, this may be beans; if the first was beans, this may be wheat drilled. In the spring of the third year the drills which rose the first year must be looked over, and the vacancies filled up from those parts which are thickest; but the drills of the ash should be let alone till the fourth year. The whole should afterwards be looked over from time to time; and this, with cultivating the intervals, and keeping the drills free from weeds, will be all that is necessary until the tops of the plants begin to interfere.

The crops may be continued for several years; and if they only pay for the expences, they will still be of considerable advantage by keeping the ground stirred, and preserving the plants from hares and rabbits. Even after the crops are discontinued, the ground ought still to be stirred, alternately throwing the mould to the roots of the plants, and gathering it into a ridge in the middle of the interval. The best method of doing this is to split the ground at the approach of winter in order to throw it up to the trees on both sides; this will preserve the roots from frost: gather it again in the spring, which will check the weeds, and give a fresh supply of air: split again at midsummer, to preserve the plants from drought: gather, if necessary, in autumn, and split as before at the approach of winter. The spring and midsummer ploughings should be continued as long as a plough can pass between the plants.

Whenever the oaks intended for timber are in danger of being drawn up too slender for their height, it will be necessary to cut off all the rest at the height of about an handbreadth above the ground; and those designed to stand must now be planted at about two rods distant from each other, and as nearly a quincunx as possible. The second cutting must be determined by the demand there is for the underwood; with only this proviso, that the timber stands be not too much crowded by it; for rather than this should be the case, the coppice should be cut, though the wood may not have reached its most profitable state. What is here said of the method of rearing oak trees in woods, is in a great measure applicable to that of raising other trees in timber groves. The species most usually raised in these are the ash, elm, beech, larch, spruce fir, Weymouth pine, poplar, willow, alder, chesnut, walnut, and cherry. The three last are used

as substitutes for the oak and beech, and these two for the mahogany.

The following account of the mode of planting that was adopted by the earl of Fife, for no less than 550 acres of moorish lands, is worthy of attention. It is contained in a letter from his lordship to the publisher of the *Annals of Agriculture*. "Where there are stones in the moor, I enclose with a stone wall five feet high, coped with two turfs, which costs about 15s. every Scots chain of 24 ells, and where there are no stones, which is mostly the case in the moors in the county of Murray, I enclose with a fence of turf, five feet high, four feet wide at the foundation, and 22 inches at top, at 4s. the Scots chain. I find those fences answer as well as the stone, for there are many of them now above 20 years old, as good as at first. I plant in every acre about 1200 trees. I used to plant above 3000, but by experience I find it better not to plant them so thick, but make them up, if necessary, the third year (especially in my plantations in the county of Murray), where scarcely a tree planted ever fails. The greatest number of the trees are Scots firs raised by myself, or purchased at 10d. the thousand, planted from the seed-bed at three years old. I only consider them as nurses to my other trees, for they are regularly cut out when they have done their duty as nurses, and are profitable for fire, and useful in agriculture. I plant every other species of forest trees intermixed with the firs. I order different pieces of the moor to be trenched where the soil is best, and most sheltered, and lay a little lime and dung on it, and in these places I sow seeds of trees for nursery. I also plant in beds, year-old trees of different kinds, taken from my other nurseries. I nurse them for three years, and then plant them all over the plantation: this I find very beneficial, as they are raised in the same soil. When I am filling up the plantations, the firs are, for the first time, cut down; or they are transplanted, being raised with balls of earth when the moor is wet with rain, which is very easily done, and they are carried to inclosures of ten or twelve acres, where, from a desire of forward woods, I am planting trees more advanced. They are planted in pits about 40 feet distance, and seldom or never fail, and answer a second time as nurses.

"My first care after the inclosure is properly filled up, is to guard against injury from cattle: a small allowance given to a few labourers answers that purpose, and if the fences are properly executed they require very little repair. After the plantation is filled up, the most regular attention must be had to the weeding of it, and this is carried on over my plantations of all ages in the most exact manner: I make roads through all the plantations, which are carried forward according to the situation, never in a straight line so as to draw violent winds, and those roads go to all parts of the plantation; they make agreeable rides through fine woods, formerly a bleak moor, and answer not only for filling up, but also for carrying away the necessary weedings. As I observed before, the value and prosperity of the wood depends upon the unremitted attention in weeding it.

"I begin to plant in October, and continue till April. If the weather is frosty and not fit for planting, all the people are employed in weeding the woods."

It is proper, however, upon this subject, to remark,

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Earl of Fife's plantations.

Cattle proper to be employed.

⁵²⁰
Where plantations are eligible or otherwise.

that the value of plantations of timber trees, as connected with other branches of agriculture, is not a little limited. In a mountainous country, and in bleak moorish situations, nothing tends more to increase the value of the soil, than plantations properly distributed. They give shelter both to the cattle and to the corn crops; and by preventing the warmth which is produced by proper manures, and by the germination of vegetables, from being dissipated, they give effect to all the efforts of industry. Accordingly, in such situations, plantations are no sooner reared, than the whole face of the country around them assumes an improving aspect, and displays a richer verdure. When suddenly cut down, in consequence of the necessities of an improvident proprietor, the reverse of all this occurs. Vegetation is chilled by the piercing blasts which now meet with no resistance, and the cattle droop from want of shelter; so that in a few years the place can scarcely be known. But the case is very different with regard to a rich and

level country that is meant to be cultivated for corn. There the effect of numerous plantations, of high trees and lofty hedge rows, is altogether distressing to the husbandman. It is only in open fields that grain appears well ripened and completely filled. When surrounded with timber trees, on the contrary, it ripens ill, and is ill-coloured and unequal. In spring the high shelter prevents the grounds from drying, and keeps back the labour. In summer the crop is liable to diseases from want of air, and is devoured by large flocks of small birds. In autumn, from want of a free circulation of air the corn ripens late, and in a weeping climate it can never be gathered in good condition. In wet seasons it is utterly ruined. In winter, when the snow is drifting about, the trees prepare a resting place for large quantities of it; these frequently remain and stop the spring work. Add to this, that in a low country even the cattle are hurt by the swarms of vermine that are bred and come forth, under the shelter of lofty tress and high fences.

Cattle proper to be employed.

PART III. OF THE CATTLE PROPER TO BE EMPLOYED IN FARM WORK; REARING AND MANAGEMENT OF THEM. OF HOGS, POULTRY, &c. OF THE DAIRY, MAKING OF FRUIT LIQUORS. OF FENCES.

SECT. I. *Of the Cattle proper to be employed.*

AS great part of the stock of a husbandman must always consist of cattle, and as one of his principal expenses must consist of the maintenance of them, this part of his business is certainly to be looked upon as extremely important. The cattle belonging to a farm may be divided into two classes, viz. such as are intended for work, and such as are designed for sale. The former are now principally horses, the oxen formerly employed being fallen into disuse, though it does not yet certainly appear that the reasons for the exchange are satisfactory.

⁵²¹
Mr Kedington's experiment on the comparative utility of horses and oxen.

In the second volume of Bath Papers, we have an account of a comparative experiment of the utility of horses and oxen in husbandry by Mr Kedington near Bury in Suffolk, in which the preference is decisively given to oxen. He informs us, that at the time he began the experiment (in 1799), he was almost certain that there was not an ox worked in the whole county; finding, however, the expence of horses very great, he purchased a single pair of oxen, but found much difficulty in breaking them, as the workmen were so much prejudiced against them, that they would not take the proper pains. At last he met with a labourer who undertook the task; and the oxen "soon became as tractable and as handy, both at ploughing and carting, as any horses." On this he determined to part with all his cart-horses; and by the time he wrote his letter, which was in 1781, he had not a single horse, nor any more than six oxen; which inconsiderable number performed with ease all the work of his farm (consisting of upwards of 100 acres of arable land and 60 of pasture and wood), besides the statute duty on the highways, timber and corn carting, harrowing, rolling, and every part of rural business. They are constantly shod; their harness is the same as that of horses (excepting the necessary alterations for difference of size and shape); they are driven with bridles and bits in their mouths, answer-

ing to the same words of the ploughman and carter as horses will do. A single man holds the plough, and drives a pair of oxen with reins: and our author informs us, that they will plough an acre of ground in less than eight hours time; he is of opinion that they could do it in seven. The intervals of a small plantation, in which the trees are set in rows ten feet asunder, are ploughed by a single ox with a light plough, and he is driven by the man who holds it. The oxen go in a cart either single, or one, two, or three, according to the load. Four oxen will draw 80 bushels of barley or oats in a waggon with ease; and if good of their kind, will travel as fast as horses with the same load. One ox will draw 40 bushels in a light cart, which our author thinks is the best carriage of any. On the whole, he prefers oxen to horses for the following reasons.

1. They are kept at much less expence, never eating meal or corn of any kind. In winter they are fed with straw, turnips, carrots, or cabbages; or instead of straw, while kept constantly at work. In the spring they eat hay; and if working harder than usual at seed-time, they have bran besides. When the vetches are fit for mowing, they get them only in the stable. After the day's work in summer they have a small bundle of hay, and stand in the stable till they cool; after which they are turned into the pasture. Our author is of opinion, that an ox may be maintained in condition for the same constant work as a horse, for at least 4l. less annually.
2. After a horse is seven years old, his value declines every year; and when lame, blind, or very old, he is scarce worth any thing; but an ox, in any of these situations, may be fatted, and sold for even more than the first purchase; and will always be fat sooner after work than before.
3. Oxen are less liable to diseases than horses.
4. Horses are frequently liable to be spoiled by servants

⁵²²
Reasons for preferring oxen to horses.

little pro- wants riding them without their master's knowledge, which is not the case with oxen.

5. A general use of oxen would make beef plentiful, and consequently all other meat; which would be a national benefit.

523
difficulty
shoeing
en. Mr Kedington concludes his paper with acknowledging that there is one inconvenience attending the use of oxen, viz. that it is difficult to shoe them; though even this, he thinks, is owing rather to the unskilfulness of the smiths who have not been accustomed to shoe these animals, than to any real difficulty. He confines them in a pound while the operation is performing.

524
Mr Marshall's calculations. Mr Marshall, in his Rural Economy of the Midland Counties, shows the advantage of employing oxen in preference to horses from the mere article of expence, which, according to his calculation, is enormous on the part of the horses. He begins with estimating the number of square miles contained in the kingdom of England; and this he supposes to be 30,000 of cultivated ground. Supposing the work of husbandry to be done by horses only, and each square mile to employ 20 horses, which is about 3 to 100 acres, the whole number used throughout Britain would be 600,000; from which deducting one-sixth of the number of oxen employed at present, the number of horses just now employed will be 500,000. Admitting that each horse works ten years, the number of farm-horses which die annually are no fewer than 50,000; each of which requires full four years keep before he is fit for work. Horses indeed are broke in at three, some at two years old, but they are, or ought to be, indulged in keep and work till they are six; so that the cost of rearing and keeping may be laid at full four ordinary years. For all this consumption of vegetable produce he returns not the community a single article of food, clothing, or commerce; even his skin for economical purposes being barely worth the taking off. By working horses in the affairs of husbandry, therefore, "the community is losing annually the amount of 200,000 years keep of a growing horse;" which at the low estimate of five pounds a-year, amounts to a million annually. On the contrary, supposing the business of husbandry to be done solely by cattle, and admitting that oxen may be fattened with the same expenditure of vegetable produce as that which old horses require to fit them for full work, and that instead of 50,000 horses dying, 50,000 oxen, of no more than 52 stone each, are annually slaughtered; it is evident that a quantity of beef nearly equal to what the city of London consumes would be annually brought into the market; or, in other words, 100,000 additional inhabitants might be supplied with one pound of animal food a-day each; and this without consuming one additional blade of grass. "I am far from expecting (says Mr Marshall), that cattle will, in a short space of time become the universal beasts of draught in husbandry; nor will I contend, that under the present circumstances of the island they ought in strict propriety to be used. But I know that cattle, under proper management, and kept to a proper age, are equal to every work of husbandry, in most, if not all situations: And I am certain, that a much greater proportion than there is at present might be worked with considerable advantage, not to the community

only, but to the owners and occupiers of lands. If on- Cattle pro- ly one of the 50,000 carcasses now lost annually to the per to be community could be reclaimed, the saving would be an employed.

526
No oxen
used in
Norfolk. In Norfolk, our author informs us, that horses are the only beasts of labour; and that there is not per- haps one ox worked throughout the whole county.

527
Objection
to them in
the Vale of
Gloucester. It is the same in the Vale of Gloucester, though oxen are used in the adjoining counties. Formerly some oxen were worked in it double; but they were found to poach the land too much, and were therefore given up. Even when worked single, the same objection is made: but, says Mr Marshall, "in this I suspect there is a spice of obstinacy in the old way; a want of a due portion of the spirit of improvement; a kind of indolence. It might not perhaps be too severe to say of the Vale farmers, that they would rather be eaten up by their horses than step out of the beaten track to avoid them." Shoeing oxen with whole shoes, in our author's opinion, might remedy the evil complained of; "but if not, let those (says he) who are advocates for oxen, calculate the comparative difference in wear and keep, and those who are their enemies estimate the comparative mischiefs of treading; and thus decide upon their value as beasts of labour in the Vale."

528
Used in the
Cotswold. In the Cotswold oxen are worked as well as horses; but the latter, our author fears, are still in the proportion of two to one: he has the satisfaction to find, however, that the former are coming into more general use. They are worked in harness; the collar and harness being used as for horses, not reversed, as in most cases they are for oxen. "They appear (says our author) to be perfectly handy; and work, either at plough or cart, in a manner which shows, that although horses may be in some cases convenient, and in most cases pleasurable to the driver, they are by no means necessary to husbandry. A convenience used in this coun- 529
Moveable
harness-
houses. try is a moveable harness-house with a sledge bottom, which is drawn from place to place as occasion may require. Thus no labour is lost either by the oxen or their drivers.

530
Why the
use of oxen
is declining
in York-
shire. In Yorkshire oxen are still used, though in much fewer numbers than formerly; but our author does not imagine this to be any decisive argument against their utility. The Yorkshire plough was formerly of such an unwieldy construction, that four or six oxen, in yokes, led by two horses, were absolutely requisite to draw it; but the improvements in the construction of the plough have of late been so great, that two horses are found to be sufficient for the purpose; so that as Yorkshire has all along been famous for its breed of horses, we are not to wonder at the present disuse of oxen. Even in carriages they are now much disused; but Mr Marshall assigns as a reason for this, that the roads were formerly deep in winter, and soft to the hoof in summer; but now they are universally a causeway of hard limestones, which hurt the feet of oxen even when shod. Thus it even appears matter of surprise to our author that so many oxen are employed in this county; and the employment of them at all is to him a convincing argument of their utility as beasts of draught. The timber carriers still continue to use them, even though their employment be solely upon the road. They find them not only able to stand working every day, provided their feet do not fail them, but

Cattle pro-
per to be
employed.

531
Superiority
of oxen to
horses.

but to bear long hours better than horses going in the same pasture. An ox in a good pasture soon fills his belly, and lies down to rest; but a horse can scarce satisfy his hunger in a short summer's night. Oxen are also considered as much superior at a difficult pull to horses; but this he is willing to suppose arises from their using half-bred hunters in Yorkshire, and not the true breed of cart horses. "But what (says he) are thorough-bred cart horses? Why, a species of strong, heavy, sluggish animals, adapted solely to the purpose of draught; and according to the present law of the country, cannot, without an annual expence, which nobody bestows upon them, be used for any other purpose. This species of beasts of draught cost at four years old from 20l. to 30l. They will, with extravagant keep, extraordinary care and attendance, and much good luck, continue to labour eight or ten years; and may then generally be sold for five shillings a head. If we had no other species of animals adapted to the purposes of draught in the island, cart horses would be very valuable, they being much superior to the breed of saddle horses for the purpose of draught. But it appears evident, that were only a small share of the attention paid to the breeding of draught oxen which is now bestowed on the breeding of cart horses, animals equally powerful, more active, less costly, equally adapted to the purposes of husbandry if harnessed with equal judgment, less expensive in keep and attendance, much more durable, and infinitely more valuable after they have finished their labours, might be produced. A steer, like a colt, ought to be familiarized to harness at two or three years old, but should never be subjected to hard labour until he be five years old; from which age until he be 15 or perhaps 20, he may be considered as in his prime as a beast of draught. An ox which I worked several years in Surry, might at 17 or 18 years of age have challenged for strength, agility, and sagacity, the best bred horse in the kingdom.

532
Horses are
everywhere
prevailing
over oxen.

Notwithstanding all that has been said, however, and written about the superiority of oxen to horses, the latter are still coming into more general use, especially in proportion as the breed of horses improves; and we may add, in proportion as the state of cultivation in any part of the country improves. The reason is obvious. The horse is a more active animal than the ox, and can be turned with greater readiness from one kind of work to another. His hoof is less readily injured by the hardness of good roads; and for the use of the plough upon a well ordered farm, there is no comparison between the two kinds of animals. Where land is once brought into a proper state of tillage, it is easily turned over; and the value of the animal employed in doing so consists not so much in the possession of great strength as in the activity which he exerts in going over a great extent of ground in a short time. In this last respect a good breed of horses so far surpasses every kind of oxen yet known in this country, that we suspect much the horse will still continue to be preferred by enterprising husbandmen.

With regard to the loss which the public is supposed to sustain by preferring horses to oxen, that point has of late been rendered, to say no more, extremely doubtful. In the Agricultural Survey of the county of Northumberland, we have the following compara-

tive statement between horses and oxen, for the purpose of the draught:—"By way of preliminary, it will be necessary to admit as data, that a horse which eats 70 bushels of oats per year, will not consume of other food so much as an ox that gets no corn; but in the following estimate we shall allow horses to eat as much as oxen, as the difference is not yet sufficiently ascertained.

Cattle pro-
per to be
employed.

533
Calcula-
tions in fa-
vour of the
use of
horses.

"That the oxen are yoked at three years old, and are worked till six, and for the first year require eight to do the work of two horses; but after having been worked a year, and become tractable and stronger, six are equal to two horses, either by being yoked three at a time, or two, and driven by the holder with cords; of course, the expence of a driver may be estimated to be saved for one half the year.

"That the expences of a ploughman, the plough, and other articles that are the same in both teams, need not be taken into the account.

"And that oxen to work regularly through the year, cannot work more than half a day at a time."

Expences of an Ox per annum.

Summering.—Grass 2 acres at 20s. per acre	L. 2 0 0
Wintering.—On straw and turnips	L. 2 0 0
But if on hay	4 0 0
The average is	3 0 0
Interest at 5 per cent. for price of the ox	L. 5 0 0
Harness, shoeing, &c.	0 10 0
	0 15 0
	6 5 0
Deduct for the increased value of an ox for 1 year	1 0 0
Gives the expence per annum of an ox for the team	5 5 0
And the expence of six oxen	L. 31 10 0
To which must be added the expence of a driver for half a year	3 10 0
Total expence of a team of 6 oxen	L. 35 0 0

An Eight-Ox team.

The expence of an ox per annum being	L. 5 5 0
	8
That of eight will be	42 0 0
To which add the expence of a driver	8 0 0
Gives the expence per annum of an eight-ox team	L. 50 0 0
Therefore the expence of a team of oxen for the first year will be	L. 50 0 0
Ditto the second year	35 0 0
Ditto the third year	35 0 0
Divided by	3)120 0 0

cattle pro-
per to be
employed.

Divided by	Brought over,	
		3)120 0 0
Gives the average expence per annum of an ox team from 3 to 6 years old		L.40 0 0

Expence of a Horse per annum.

Summering.—Grass 2 acres at 20s. per acre	L.2 0 0
Wintering.—Straw 13 weeks at 9d. per week	0 10 0
Hay 16 ditto 1½ tons at 2l.	3 0 0
Corn (for a year) 70 bushels of oats at 2s.	7 0 0
Shoeing and harness	1 0 0
Annuity to pay off 25l. in 16 years, the purchase value of the horse at four years old	2 5 0
Expence of a horse per annum	L.15 15 0
Expence of a two-horse team	L.31 10 0

"If a three-horse team be used, the account will stand thus:

The expence of a horse per annum being	L.15 15 0
	3
That of three will be	47 5 0
To which add the expence of a driver	8 0 0

Gives the expence of a three-horse team L.55 5 0

"If the comparison be made with the horse team of many of the midland counties, where they use *five horses yoked one before another in one plough*, the account will stand thus:

The expence of one horse per annum being	L.15 15 0
	5
That of five will be	78 15 0
To which add the expence of a man to drive	18 0 0

To expence of a team of five horses } will be	L.96 15 0
ditto of 3 ditto	55 5 6
ditto of 2 ditto	31 10 0
ditto of 8 oxen	50 0 0

The average expence of an ox-team from three to six years old, that will do the same quantity of work as two horses 40 0 0

"The conclusions to be drawn from the above statement are so obvious as to need little elucidation. But we cannot help remarking, how strong the force of prejudice must be, to continue the use of five horses, and heavy, clumsy, unwieldy *wheel ploughs*, where a single *swing plough* and two horses yoked double, and driven by the holder, would do the same quantity of work, equally well and at one half of the expence."

"But before any proper conclusion can be drawn, whether *ox teams* or *horse* are the most eligible, it will be necessary to consider, whether the quantity of land

employed in supporting those animals, be used in the most profitable mode to the community, as well as to the occupier.

"With the latter, the first question for consideration is, whether eight oxen used in the team or in grazing will pay him the most money?

"Suppose eight oxen, at *three years old*, were put to the plough, and plough six acres per week, which, at 3s. 4d. per acre, is 20s.; and if they work forty-eight weeks in a year, their whole earnings (after deducting 6l. for expences of harness, shoeing, &c.) will be 42l.; but if they plough only *five acres per week* (which is probably nearer the truth), then their whole earnings will be only 34l.

"The same oxen put to graze at the same money should improve in value 5l. 5s. each in the first case, and 4l. 5s. in the latter; but we are inclined to believe there are few situations, if the cattle are of a good quick-feeding kind, where they would not pay considerably more.

"In respect to the community, the account will be nearly as follows:

From the above statements, we find that an ox for summering and wintering requires	3½ acres
Therefore a six-ox team will require	21 ditto
And two horses for grass and hay per annum require	7 ditto
For corn and straw	4 ditto
Land necessary for keeping two horses per annum	11 ditto

The difference in the quantity of land required for a team of oxen more than horses 10 ditto.

"Hence it appears, that a team of six oxen requires ten acres more land to maintain them, than a team of two horses, which will do the same work; and of course the produce which might be derived from these ten acres is lost to the community. Suppose it be one half in grass, the other half in tillage, then we shall have

5 Acres of clover or grass,
1½ Ditto of oats,
1½ Ditto of turnips or fallow,
1½ Ditto of wheat.

"It would then send to market yearly, at the lowest computation,

7½ cwt. of beef,
8 quarters of oats,
And 5 ditto of wheat.

"From this view of the subject, it appears that if oxen were universally used for the draught, in the room of horses, there would be a considerable defalcation, in the supply of the markets, both in corn and animal food. And the loss to the farmer would be the profit derived from the produce; which, by the usual mode of allowing one-third for the farmer's profit, would in this case be about 10l."

SECT. II. *Of the different kinds of Horses, and the Method of Breeding, Rearing, and Feeding them.*

The midland counties of England have for some time been celebrated on account of their breed of the black *black cart-horse*; though Mr Marshall is of opinion that this kind are unprofitable as beasts of draught in husbandry.

Different
Kinds of
Horses.

Different
Kinds of
Horses.

bandry. The present improvement in the breed took its rise from six Zealand mares sent over by the late Lord Chesterfield during his embassy at the Hague. These mares being lodged at his lordship's seat at Bretby in Derbyshire, the breed of horses thus became improved in that county, and for some time it took the lead for the species of these animals. As the improved breed passed into Leicestershire, however, through some unknown circumstances, it became still more improved, and Leicester has for some time taken the lead. It is now found, however, that the very large horses formerly bred in this district are much less useful than such as are of a smaller size. Mr Marshall describes in magnificent terms one of these large horses, a stallion belonging to Mr Bakewell named K (Q), which, he says, was the handsomest horse he ever saw. "He was (says he) the fancied *war-horse* of the German painters; who, in the luxuriance of imagination, never perhaps excelled the natural grandeur of this horse. A man of moderate size seemed to shrink behind his fore end, which rose so perfectly upright, his ears stood (as Mr Bakewell says every horse's ears ought to stand) perpendicularly over his fore-feet. It may be said, with little latitude, that in grandeur and symmetry of form, viewed as a picturable object, he exceeded as far the horse which this superior breeder had the honour of showing to his Majesty, and which was afterwards shown publicly at London, as that horse does the meanest of the breed." A more *useful* horse, bred also by Mr Bakewell, however, is described as having a "thick carcase, his back short and straight, and his legs short and clean; as strong as an ox, yet active as a poney; equally suitable for a cart or a light-carriage."

535
Horses be-
longing
Mr Bake-
well descri-
bed.

The stallions in this county are bred either by farmers or by persons whose business it is to *breed* them, and who therefore have the name of *breeders*. These last either cover with themselves, or let them out to others for the season, or sell them altogether to stallion-men who travel about with them to different places. The prices given for them are from 50 to 200 guineas by purchase; from 40 to 80 or a hundred by the season; or from half a guinea to two guineas by the mare. The mares are mostly kept by the farmers, and are worked until near the times of foaling, and moderately afterwards while they suckle: the best time for foaling is supposed to be the month of March or April; and the time of weaning that of November.—"The price of foals (says Mr Marshall), for the last ten years, has been from five to ten pounds or guineas; for yearlings, 10 to 15 or 20; for two-year olds, 15 to 25 or 30; for six-year olds, from 25 to 40 guineas."—Our author acknowledges that this breed of horses, considered abstractedly in the light in which they appear here, are evidently a profitable species of live stock, and as far as there is a market for six-years old horses of this breed, it is profitable to agriculture. "But (says he) viewing the business of agriculture in general, not one occupier in ten can partake of the profit; and being kept in agriculture after they have reached that profitable age, they be-

come indisputably one of its heaviest burdens. For besides a cessation of improvement of four or five guineas a-year, a decline in value of as much yearly takes place. Even the brood-mares, after they have passed that age, may, unless they be of a very superior quality, be deemed unprofitable to the farmer."

Our author complains that the ancient breed of Norfolk horses is almost entirely worn out. They were small, brown-muzzled, and light boned; but they could endure very heavy work with little food; two of them were found quite equal to the plough in the soil of that county, which is not deep. The present breed is produced by a cross with the large one of Lincolnshire and Leicestershire already mentioned. He approves of the Suffolk breed, which (he says) are a "half-horse half-hog race of animals, but better adapted to the Norfolk husbandry than the Leicestershire breed: their principal fault, in his opinion, is a flatness of the rib.—In the Vale of Gloucester most farmers rear their own plough-horses, breeding of horses not being practised. They are of a very useful kind, the colour mostly black, inclinable to tan colour, short and thick in the barrel, and low on their legs. The price of a six-year old horse from 25l. to 35l. Some cart-horses are bred in Cotswold hills; the mares are worked till the time of foaling, but not while they suckle; and the foals are weaned early, while there is plenty of grass upon the ground.

Yorkshire, which has been long celebrated for its breed of horses, still stands foremost in that respect among the English counties. It is principally remarkable for the breed of saddle-horses, which cannot be reared in Norfolk, though many attempts have been made for that purpose. Yorkshire stallions are frequently sent into Norfolk; but though the foals may be handsome when young, they lose their beauty when old. In Yorkshire, on the other hand, though the foal be ever so unpromising, it acquires beauty, strength, and activity as it grows up. Mr Marshall supposes that from five to ten thousand horses are annually bred up between the eastern Morelands and the Humber.

"Thirty years ago (says Mr Marshall), strong saddle horses, fit for the road only, were bred in the Vale; but now the prevailing breed is the fashionable coach-horse, or a tall, strong, and over-sized hunter; and the shows of stallions in 1787 were flat and spiritless in comparison with those of 1783." The black cart-horse, an object of Mr Marshall's peculiar aversion, is also coming into the Vale.

In the breeding of horses he complains greatly of the negligence of the Yorkshire people, the mares being almost totally neglected; though in the brute creation almost every thing depends upon the female.

Of late years a very valuable breed of horses has been reared in the upper part of Clydesdale or Lanarkshire. They are of a middle size, well shaped, and extremely active. They are not fit for a very heavy draught, but the very quick step which they possess gives them a decided preference for the use of the plough upon well cultivated lands, as they are capable of going over an immense quantity of ground in a short time.

536
Prices of
stallions.

537
Mr Marshall's ob-
servations on breed-
ing horses.

Different
Kinds of
Horses.

538
Norfolk
bred de-
scribed.

539
Suffolk and
Gloucester
breeds.

540
Yorkshire
horses.

541
Lanark-
shire breed
of horses.

Different Kinds of Horses. time where the draught is not severe. The same qualities render them highly useful for the ordinary purposes of farm-work. They are rapidly spreading over all parts of the country, and have found their way into the north of England, where they are greatly valued. In the same part of the country, a larger breed has also of late been encouraged, which adds very considerable strength or power to the activity of the former kind. They are in great request about Glasgow and other manufacturing towns. Their usual draught is a load of about 24 cwt. in addition to the cart on which the load is placed.

542
Norfolk management of horses recommended.

With regard to the general maintenance of horses, we have already mentioned several kinds of food upon which experiments have been made with a view to determine the most profitable mode of keeping them. Perhaps, however, the most certain method of ascertaining this matter is by observing the practice of those counties where horses are most in use. Mr Marshall recommends the Norfolk management of horses as the cheapest method of feeding them practised anywhere; which, however, he seems willing to ascribe in a great measure to the excellency of their breed. In the winter months, when little work is to be done, their only rack-meat is barley-straw; a reserve of clover-hay being usually made against the hurry of seed-time. A bushel of corn in the most busy season is computed to be an ample allowance for each horse, and in more leisure times a much less quantity suffices. Oats, and sometimes barley, when the latter is cheap and unsaleable are given; but in this case the barley is generally malted, i. e. steeped and afterwards spread abroad for a few days, until it begin to vegetate, at which time it is given to the horses, when it is supposed to be less heating than in its natural state. Chaff is universally mixed with horse-corn: the great quantities of corn grown in this county afford in general a sufficiency of natural chaff; so that cut chaff is not much in use: the chaff, or rather the awns of barley, which in some places are thrown as useless to the dunghill, are here in good esteem as provender. Oat-chaff is deservedly considered as being of much inferior quality.—It may here be remarked, that this method of keeping horses which Mr Marshall approves of in the Norfolk farmers, is practised, and probably has been so from time immemorial, in many places of the north of Scotland; and is found abundantly sufficient to enable them to go through the labour required. In summer they are in Norfolk kept out all night, generally in clover leys, and in summer their keep is generally clover only, a few tares excepted.

543
This method followed in many places in Scotland.

544
Calculations of the expence of keeping horses.

In the 4th volume of the Annals of Agriculture, Mr Young gives an account of the expence of keeping horses; which, notwithstanding the vast numbers kept in the island, seems still to be very indeterminate, as the informations he received varied no less than from 8l. to 25l. a-year. From accounts kept on his own farm of the expence of horses kept for no other purpose than that of agriculture, he stated them as follows:

	L.	s.	d.
1763 Six horses cost per horse	10	13	0
1764 Seven do. - -	8	10	11
1765 Eight do. - -	14	6	6
1766 Six do. - -	12	18	9

Average on the whole, 11l. 12s. 3d.

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By accounts received from Northmims in Herefordshire, the expences stood as follows:

Different Kinds of Horses.

	L.	s.	d.
1768 Expence per horse	20	7	0
1769 - - -	15	8	5
1770 - - -	14	14	2
1771 - - -	15	13	3
1772 - - -	18	4	0
1773 - - -	15	11	8
1774 - - -	14	4	5
1775 - - -	19	0	5
1776 - - -	16	14	5
Average 16l. 13s. 1d.			

On these discordant accounts Mr Young observes, undoubtedly with justice, that many of the extra expences depend on the extravagance of the servants; while some of the apparent savings depend either on their carelessness, or *stealing* provender to their beasts privately, which will frequently be done. He concludes, however, as follows: "The more exactly the expence of horses is examined into, the more advantageous will the use of oxen be found. Every day's experience convinces me more and more of this. If horses kept for use alone, and not for show, have proved thus expensive to me, what must be the expence to those farmers who make their fat sleek teams an object of vanity? It is easier conceived than calculated."

It must be observed, however, that the above trials or accounts are of an old date; and that during the late dearth a variety of experiments were made, which shew that horses may be successfully fed, even when engaged in hard labour, with other articles than grain. With this view, different roots have been given them as substitutes; and a great saving has been experienced, attended with no loss of labour or disadvantage to the animal: so that the continuance and extension of this system is a matter of much importance to the public. The articles that have been chiefly employed are turnips, roota бага, potatoes, carrots, &c.—Turnips have been given in a raw state, withholding about one half of the usual allowance of corn, and in most instances the animals have done their work well, and appeared in good condition. When the roota бага has been used, little or no grain has been necessary, and the other roots already mentioned have been successfully used even in a raw state; but when potatoes, yams, roota бага, &c. are boiled, which has sometimes been done, it does not appear that grain is at all necessary. It is to be observed, that young horses eat these roots readily and with great relish; and that, during the winter, with them and a small portion of dry food, they are kept in as good condition and spirit as when fed upon grass during the summer. This is a matter of much importance to young animals, as it must contribute greatly to their growth and future strength. Whereas, in a great majority of cases, when reared without the aid of these roots, they are fed in winter, when substantial food is most necessary to support them against the severity of the weather, in such a manner as to be barely kept alive. During the winter months their growth is thus stopt; they lose the little flesh they had acquired during the preceding summer, become stunted and hide-bound, and, when the spring arrives, they are in so miserable a state, that a considerable part even of the summer elapses before they

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Use of roots for feeding horses.

Breeding and Feeding of Black Cattle. can resume their growth. In this way four or five years are required to bring them to the size that others of the same species attain in half that time under different management.

SECT. III. Of the Breeding and Rearing of Black Cattle.

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A hornless breed of black cattle desirable for work.

THESE are reared for two different purposes, viz. work, and fattening for slaughter. For the former purpose, Mr Marshall remarks that it is absolutely necessary to procure a breed without horns. This he thinks would be no disadvantage, as *horn*, though formerly an article of some request, is now of very little value. The horns are quite useless to cattle in their domestic state, though nature has bestowed them upon them as weapons of defence in their wild state; and our author is of opinion that it would be quite practicable to produce a hornless breed of black cattle as well as of sheep, which last has been done by attention and perseverance; and there are now many hornless breeds of these creatures in Britain. Nay, he insists that there are already three or four breeds of hornless cattle in the island; or that there are many kinds of which numbers of individuals are hornless, and from these, by proper care and attention, a breed might be formed. The first step is to select females; and having observed their imperfections, to endeavour to correct them by a well chosen male.

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Properties requisite in black cattle.

The other properties of a perfect breed of black cattle for the purposes of the dairy as well as others, ought, according to Mr Marshall, to be as follow: 1. The head small and clean, to lessen the quantity of offal. 2. The neck thin and clean, to lighten the fore-end, as well as to lessen the collar, and make it sit close and easy to the animal in work. 3. The carcass large, the chest deep, and the bosom broad, with the ribs standing out full from the spine; to give strength of frame and constitution, and to admit of the intestines being lodged within the ribs. 4. The shoulders should be light of bone, and rounded off at the lower point, that the collar may be easy, but broad to give strength, and well covered with flesh for the greater ease of draught, as well as to furnish a desired point in fattening cattle. 5. The back ought to be wide and level throughout; the quarters long; the thighs thin, and standing narrow at the round bone; the udder large when full, but thin and loose when empty, to hold the greater quantity of milk; with large dug veins to fill it, and long elastic teats for drawing it off with greater ease. 6. The legs (below the knee and hock) straight, and of a middle length; their bone, in general, light and clean from fleshiness, but with the joints and sinews of a moderate size, for the purposes of strength and activity. 7. The flesh ought to be mellow in the state of fleshiness, and firm in the state of fatness. 8. The hide mellow, and of a middle thickness, though in our author's opinion this is a point not yet well determined.

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Of rearing calves without milk.

As the milk of cows is always an article of great importance, it becomes an object to the husbandman, if possible, to prevent the waste of this useful fluid, which in the common way of rearing calves is unavoidable. A method of bringing up these young animals at less expence was at one time proposed by the duke of Nor-

thumberland. His plan was to make skimmed milk answer the purpose of that which is newly drawn from the teat; and which, he supposed, might answer the purpose at one-third of the expence of new milk. The articles to be added to the skimmed milk are treacle and the common linseed oil-cake ground very fine, and almost to an impalpable powder, the quantities of each being so small, that to make 32 gallons would only cost 6d. besides the skimmed milk. It mixes very readily and almost intimately with the milk, making it more rich and mucilaginous, without giving it any disagreeable taste. The receipt for making it is as follows: Take one gallon of skimmed milk, and to about a pint of it add half an ounce of treacle, stirring it until it is well mixed; then take one ounce of linseed oil-cake finely pulverized, and with the hand let it fall gradually in very small quantities into the milk, stirring it in the mean time with a spoon or ladle until it be thoroughly incorporated; then let the mixture be put into the other part of the milk, and the whole be made nearly as warm as new milk when it is first taken from the cow, and in that state it is fit for use. The quantity of the oil-cake powder may be increased from time to time as occasion requires, and as the calf becomes inured to its flavour. On this subject Mr Young remarks, that in rearing calves, there are two objects of great importance. 1. To bring them up without any milk at all; and, 2. To make skimmed milk answer the purpose of such as is newly milked or sucked from the cow. In consequence of premiums offered by the London Society, many attempts have been made to accomplish these desirable purposes; and Mr Budel of Wanborough in Surrey was rewarded for an account of his method. This was no other than to give the creatures a gruel made of ground barley and oats. Mr Young, however, who tried this method with two calves, assures us that both of them died, though he afterwards put them upon milk when they were found not to thrive. When in Ireland he had an opportunity of purchasing calves at three days old from 20d. to 3s. each; by which he was induced to repeat the experiment many times over. This he did in different ways, having collected various receipts. In consequence of these he tried hay-tea, bean-meal mixed with wheat-flour, barley and oats ground nearly, but not exactly, in Mr Budd's method; but the principal one was flax-seed boiled into a jelly, and mixed with warm water; this being recommended more than all the rest. The result of all these trials was, that out of 30 calves only three or four were reared; these few were brought up with barley and oat-meal, and a very small quantity of flax-seed jelly; one only excepted, which at the desire of his coachman was brought up on a mixture of two-thirds of skimmed milk and one-third of water, with a small addition of flax jelly well dissolved.

The second object, viz. that of improving skimmed milk, according to the plan of the duke of Northumberland, seems to be the more practicable of the two. Mr Young informs us, that it has answered well with him for two seasons; and two farmers to whom he communicated it gave also a favourable report.

In the third volume of the same work, we are informed that the Cornwall farmers use the following method in rearing their calves. "They are taken from

Breeding and Feeding of Black Cattle.

Annals of Agriculture. vol. i. p. 296.

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Mr Young's experiments.

Breeding and Feeding of Black Cattle. 550
Method of rearing calves in Cornwall. 551
Mr Crook's method.

from the cow from the fourth to the sixth day; after which they have raw milk from six to ten or fourteen days. After this, they feed them with scalded skimmed milk and gruel made of shelled oats, from three quarts to four being given in the morning, and the same in the evening. The common family broth is thought to be as good, or better, than the gruel, the savour of the salt being supposed to strengthen their bowels. The proportion of gruel or broth is about one-third of the milk given them. A little fine hay is set before them, which they soon begin to eat.

In the 5th volume of Bath Papers, we have an account by Mr Crook of a remarkably successful experiment on rearing calves without any milk at all. This gentleman, in 1787, weaned 17 calves; in 1788, 23; and in 1789, 15. In 1787, he bought three sacks of linseed, value 2l. 5s. which lasted the whole three years. One quart of it was put to six quarts of water; which, by boiling 10 minutes, was reduced to a jelly: the calves were fed with this, mixed with a small quantity of tea, made by steeping the best hay in boiling water. By the use of this food three times a-day, he says that his calves thrive better than those of his neighbours, which were reared with milk. These unnatural kinds of food, however, are in many cases apt to produce a looseness, which in the end proves fatal to the calves. In Cornwall, they remedy this sometimes by giving acorns as an astringent; sometimes by a cordial used for the human species, of which opium is the basis.

In Norfolk, the calves are reared with milk and turnips; sometimes with oats and bran mixed among the latter. Winter calves are allowed more milk than summer ones; but they are universally allowed new milk, or even to suck. In the midland counties bull-calves are allowed to remain at the teat until they be six, nine, or twelve months old, letting them run either with their dams or with cows of less value bought on purpose. Each cow is generally allowed one male or two female calves. Thus they grow very fast, and become surprisingly vigorous. The method of the dairy-men is to let the calves suck for a week or a fortnight, according to their strength; next they have new milk in pails for a few meals; after that, new and skimmed milk mixed; then skimmed milk alone, or porridge made with milk, water, ground oats, &c. sometimes with oil-cake, &c. until cheese-making commences; after which they have whey-porridge, or sweet whey in the field, being carefully housed in the night until the warm weather comes in.

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Mr Brad-
te's mode.

A late intelligent Scottish clergyman, Mr John Bradfute of Dunsyre, once or twice successfully made trial of treacle, as a food by means of which to rear calves without the aid of any kind of milk. He used it diluted with common water, and sometimes with what is called *hay-tea*, that is to say, water in which hay had been boiled. The whole expence of the treacle necessary to bring a calf the length of using common food was at that time (15 years ago) about 4s. 6d. The animals came forward well, and enjoyed good health; but they grew much to the bone, and did not fatten for a considerable time.

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cattle are
pastured,

For feeding cattle, two modes of practice have been proposed, and in some situations adopted; the one mode, which is the most ancient, and the most exten-

sively practised in agricultural countries, consists of turning out the cattle during the whole season that any food for them can be found on the ground, and of taking them into the house during the severity of winter, and of feeding them with such articles as can be most conveniently procured in the climate and situation, such as, straw or hay of different kinds, and roots.

The other mode, which has been adopted to some extent by husbandmen in Germany, and at times also in our own great towns, by persons called *cow-feeders*, who supply the inhabitants with milk, is called the system of stall-feeding. It consists of keeping the cattle continually in the house at every season of the year, and of feeding them there. By many German writers upon rural economy this system is highly approved of, as affording the means of drawing the highest possible produce from every portion of the land, and as employing a great number of hands in the useful occupations of husbandry. In a communication to the Board of Agriculture from A. Thaer, M. D. physician of the electoral court of Hanover, the advantages of this system are said to be founded upon the following incontrovertible principles:

“1. A spot of ground which, when pastured upon, will yield sufficient food for only one head, will abundantly maintain four head of cattle in the stable, if the vegetables be mowed at a proper time, and given to the cattle in a proper order.

“2. The stall-feeding yields at least double the quantity of manure from the same number of cattle; for the best and most efficacious summer manure is produced in the stable, and carried to the fields at the most proper period of its fermentation, whereas, when spread on the meadow, and exhausted by the air and sun, its power is entirely wasted.

“3. The cattle used to stall-feeding will yield a much greater quantity of milk, and increase faster in weight when fattening, than when they go to the field.

“4. They are less subject to accidents, do not suffer by the heat, by flies, and insects, are not affected by the baneful fogs which are frequent in Germany, and bring on inflammations: on the contrary, if every thing be properly managed, they remain in a constant state of health and vigour.”

It is added that a sufficient, or rather plentiful supply of food for one head of cattle daily, if kept in a stable, consists upon an average of 130 pounds of green or 30 pounds of dry clover, which answers the same purpose. Hence one head of cattle requires in 365 days, about 10,950 pounds of dry clover, or about 100 cwts. of 110 pounds each, the portion of food being according to this mode of feeding alike both in summer and winter. Each head of heavy fat cattle fed in the stable, if plenty of food be given, yields annually 16 double cart loads of dung. The rotation of crops that is most frequently used in Germany upon farms occupied in stall-feeding, appears to be the following: “One year, manured for beans, pease, cabbages, potatoes, turnips, linseed, &c.; 2. Rye; 3. Barley, mixed with clover; 4. Clover, to be mowed two or three times; 5. Clover, to be mowed once, then to be broken up, ploughed three or four times, and manured; 6. Wheat; 7. Oats.”—In consequence of the large quantity of stable dung produced

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and Feed-
ing of
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tle.

duced upon farms thus occupied, every acre of land receives every three years 10 double cart loads of that best of all kinds of manure.

It is undoubtedly to be wished that a similar mode of management could be profitably introduced into this country, from the tendency which it would have to augment the number of persons occupied in rural affairs, from the importance which it would give to farms of a moderate extent, and from the benefit which must arise from making the most of every part of the soil. It has already been introduced into several places in England, and we have little doubt that the practice will gradually extend itself, in consequence of the increasing demand for butcher's meat, and for all the productions of the dairy.

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Two modes
of stall-
feeding.

Of stall-feeding, however, whether with a view to the maintenance or to the fattening of cattle, it must be observed, that there are two modes of proceeding. Of late years, it has been found advantageous to cultivate to a great extent turnips, potatoes, and other roots, and these now constitute a large portion of the winter food of cattle. These roots are either given to the cattle in their natural raw state, or they are given after being boiled. Of these two modes of feeding, that of giving them to the cattle raw has hitherto been the most common, but it is extremely improper, as being a thriftless plan of proceeding. The same quantity of these roots, if given in a raw state, that will barely support a horse in idleness, will enable him, when boiled, to encounter the severest labour without injury to his health or spirit. There are many animals also, such as hogs, which cannot be fattened by roots unless they undergo this process. These animals can be reared to the full size upon raw potatoes, yams, carrots, roota бага, &c. and may be kept in good health for any length of time without the aid of any other food. Under that management, however, they very seldom if ever fatten; but when the roots are boiled, they immediately begin to feed, and soon become fat upon a smaller allowance than what was necessary to keep them barely alive when given in a raw state.

The same holds true in a great degree with regard to all cattle. With a view, therefore, to make the most of the various succulent roots which are now cultivated, and which will perhaps one day be accounted the most valuable productions of our soil, it is absolutely necessary that they should be given to cattle boiled. Many husbandmen have long been sensible of this, but it has appeared a very formidable operation to boil the greatest part of the food of perhaps 20 horses, and 100 head of black cattle. There is nothing more true, however, than that this labour when undertaken upon skilful principles, may be rendered not only easy, but so trifling, that it may be performed by a single old man, or by a woman. To accomplish this object, however, it is necessary, that the roots be boiled not over the fire in a caldron of metal, but at a distance from it in a large wooden vat or tub by the steam of boiling water.

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Roots gi-
ven to cat-
tle should
be boiled.

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Cheap
mode of
boiling
roots by
steam.

There are two ways of boiling roots by steam. They may either be boiled in such a way as to retain their original figure, or they may be converted into soup; both modes are performed with equal ease. All that is necessary, is to erect a boiler in any outhouse: The boiler, which may be of cast iron, ought to have a close

cover or lid, having a small hole for filling it with water, which can be easily closed up, and another hole in the centre, of about one-fourth of the diameter of the cover. To this last hole ought to be soldered a tube of tin-plate, commonly called *white iron*, by which the steam may ascend. This tube ought to rise perpendicularly to the height of six feet, narrowing gradually to about two inches diameter. It may then bend off at right angles, to the most convenient situation for the tub or vat in which the roots are to be boiled. When it comes perpendicularly over the centre of the vat, it must be made to descend to within two or three inches of the bottom of it, being properly supported and fixed all the way.

To boil roots with this apparatus, it is only necessary to tumble them into the tub or vat into which the end of the white-iron tube descends. The tub ought then to be covered negligently. The water in the boiler being heated to ebullition, its steam or vapour rises and passes along the white-iron tube, and at last descends to the bottom of the wooden vessel containing the roots, and in a very trifling space of time renders them completely soft. If it is wished to convert these roots into soup, it is only necessary to throw among them a quantity of water, and to mash them down with any large ladle or other instrument. The steam continuing to descend will speedily boil the water, and agitate and mingle the whole ingredients of which the soup may be composed. In this way by various mixtures of roots, with little or no trouble, rich broths, which human beings would not dislike, may be formed for feeding a multitude of cattle, and the soup may easily be drawn off from the bottom of the vat by means of a hole to be occasionally opened or shut with a round piece of wood.

In performing the above operation, however of forming broth or soup, before allowing the water in the vessel over the fire to give over boiling, the hole ought to be opened by which it is usually filled with water, as the liquor in the vat might otherwise, in consequence of the pressure of the atmosphere, ascend through the white-iron tube and come over into the boiler. To strengthen the white-iron tube, it may be proper also to cover it all over with paper pasted to it with glue, or with a mixture of pease-meal and water.

To fatten cattle with success, then, we apprehend that the following rules ought to be adhered to. As a man is kept thin and meagre by whatever agitates his mind, or renders him anxious, fretful, and uncomfortable, so we ought to consider that cattle, though they want foresight of the future, have nevertheless minds capable of being irritated and disturbed, which must so far waste their bodies. In attempting to fatten them, therefore, care ought to be taken to preserve the tranquillity of their minds, and as much as possible to keep them in a state of cleanness and of moderate warmth. The food they receive ought to be varied at times to increase their appetite; but above all things it ought to be made as far as possible of easy digestion, that they may receive it in larger portions, and that a greater quantity of it may incorporate with their constitution, and not be thrown off by dung, as happens when they receive coarse nourishment. It is in vain to object to this artificial mode of proceeding, that the natural food of animals is grass alone, and that their natural.

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ing of
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tle.

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Rules for
fattening
cattle.

Rearing natural dwelling is the open air. The same might be said with regard to the human species. In his natural, that is, in his unimproved state, a savage may be under the necessity of eating raw flesh or herbs, or of climbing into a tree for shelter; but although it may be possible for him to subsist in this way, yet we know that this is by no means the best mode of his existence, and that his life and health are better preserved by the shelter of a settled dwelling, and by more delicate food, prepared by industry. In the same manner it is no doubt true, that cattle can exist upon very coarse food, and may be even fattened by means of it; but as a greater quantity of it becomes necessary, the husbandman's profit in rearing them is so far diminished, and the value of his lands to the community is lessened.

SECT. IV. *Of the Rearing and Fattening of Hogs.*

THE practice of keeping these animals is so general, especially in England, that one should think the profit attending it would be absolutely indisputable; and this the more especially, when it is considered how little nicety they have in their choice of food. From such experiments, however, as have been made, the matter appears to be at least very doubtful, unless in particular circumstances. In the first volume of *Annals of Agriculture*, we have an experiment by Mr Mure of feeding hogs with the cluster potato and carrots; by which it appeared, that the profit on large hogs was much greater than on small ones; the latter eating almost as much as the former, without yielding a proportionable increase of flesh. The gain was counted by weighing the large and small ones alive; and it was found, that from November 10th to January 5th, they had gained in the following proportion:

20 large hogs,	-	-	L. 1	3	6
20 small,	-	-	0	7	8
2 stag hogs,	-	-	1	17	8

On being finished with pease, however, it appeared, that there was not any real profit at last; for the accounts stood ultimately as follow:

Dr		Cr	
Value of hogs at putting up,	L. 44 2 0	42 hogs sold fat at	L. 95 0 0
33 comb pease, at 14s.	23 2 0		
2 ditto, 2 bushels barley, at 14s.	1 15 0		
56 days attendance of one man, at 14d.	3 5 4		
950 bushels of carrots, and 598 of potatoes, at 3½d. per bushel,	22 15 8		
	<hr/> L. 95 0 0		<hr/> L. 95 0 0

In some experiments by Mr Young, related in the same volume, he succeeded still worse, not being able to clear his expences. His first experiment was attended with a loss of one guinea per hog; the second with a loss of 11s. 8d.; the third, of only 3s. In these three the hogs were fed with pease; given whole in the two

first, but ground into meal in the last. The fourth experiment, in which the hog was fed with Jerusalem artichokes, was attended with no loss; but another, in which pease were again tried, was attended with a loss of 4s. Other experiments were tried with pease, which turning out likewise unfavourable, barley was tried ground along with pease and peans. This was attended with a small profit, counting nothing for the trouble of feeding the animals. The expences on two hogs were 14l. 13s. 10½d. the value 15l. 11s. 3¾d. so that there was a balance in his favour of 17s. 4½d. In another experiment, in which the hogs were fed with pease and barley ground, the beans being omitted as useless, there was a profit of 12s. 3d. upon an expence of 20l. 15s. 9d.; which our author supposes would pay the attendance. In this experiment the pease and barley meal were mixed into a liquor like cream, and allowed to remain in that state for three weeks till it became sour. This was attended in two other instances with profit, and in a third with loss: however, Mr Young is of opinion, that the practice will still be found advantageous on account of the quantity of dung raised; and that the farmer can thus use his pease and barley at home without carrying them to market.

It is to be observed, that the above experiments were not made upon the fattening of hogs in the proper manner in which that animal ought to be fed. Its food ought undoubtedly to consist chiefly of roots, such as yams, potatoes, &c.; but these roots, as already mentioned, ought always to be boiled, or made into soups. With this mode of proceeding, the hog, from its rapid multiplication, and quick growth, is a very profitable kind of stock.

Hogsties are of simple construction; they require only a warm dry place for the swine to lie in, with a small area before, and troughs to hold their food. They are generally made with shed roofs, and seldom above 6 or 7 feet wide.

Although swine are generally considered as the filthiest of all animals, yet there is no animal delights more in a clean comfortable place to lie down in, and none that cleanliness has a better effect upon with respect to their thriving and feeding. In order to keep them dry, a sufficient slope must be given, not only to the inside where they lie, but to the outside area, with proper drains to carry off all moisture. The inside should also be a little elevated, and have a step up from the area at least 5 or 6 inches. *Hogsties* should have several divisions to keep the different sorts of swine separate, nor should a great many ever be allowed to go together; for it is thought they feed better in small numbers, and of equal size, than when many are put together of different sizes. Proper divisions must therefore be made, some for swine when with the boar, others for brood swine, and for them to farrow in, for weaning the pigs, for feeding, &c.

Swine are apt to spill and waste a great deal of their meat by getting their feet among it, unless proper precautions are taken to prevent them. This may be done by making a rail or covering of thin deal slope from the back part of the trough towards the fore part, leaving just room enough to admit their heads. There should also be divisions across the troughs, according to the number of swine, to prevent the strongest driving away the

Rearing and Fattening Hogs.

Description of a proper hogsty.

Sheep.

the weakest. These divisions need not extend to the bottom of the troughs, but should rise a little higher than the top, and may be made of pieces of board about 8 or 10 inches broad.

Sties ought to be constructed that the swine may be easily fed without going in among them. In some places it is so contrived that they may be fed through openings in the back kitchen wall, without even going out of doors. This is very convenient where only a few swine are kept for family use, and makes it easy to give them the refuse of vegetables and other things from the kitchen, which perhaps, would otherwise be thrown away. Where pigs are to be reared on an extensive scale, there ought to be what is called in England a *pigs kitchen*, that is, a proper apparatus ought to be erected adjoining to the hogsty, for boiling their food. To avoid expence, steam ought always to be used for this purpose, in the way already described.

SECT. V. *Sheep.*

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Experiments on
feeding
sheep with
roots.

THE rearing of sheep properly belongs to the article pasturage. So far, however, as they are fed upon the products of human industry, they belong to the present subject. In the Memoirs of the Royal Society of Agriculture in Paris for the year 1788, the result is given of certain experiments upon the advantage and economy of feeding sheep in the house with roots. The experiments were made by M. Cretté de Palluel. He states that the custom of feeding sheep in a house is common in several of the French provinces, but in others is unknown: That the mode of fattening them in that situation consisted of giving them clean corn and choice hay: That in substituting roots for corn, hay was continued to be given to them, either of clover, lucern, after-math, or any other sort. The corn commonly used for fattening sheep is barley and oats. Sometimes gray pease, or the marshed bean, and rye. "Although the sheep fed upon roots (says M. Cretté) did not acquire quite so great a degree of fatness as those fed upon corn, it is however true, that they all fattened, and that if their food had been varied, they would have made great progress: I can even assert the fact of four, which were put upon change of food towards the end of the experiment, and ate much more.

"The sheep put to potatoes ate little at first, for some days, which prevented them from thriving so much as the others; but they recovered the second month what they lost the first. As for those put to turnips and beets, they fed heartily from the first moment, and continued it. They all drank much less than those fed upon corn.

"Corn might with advantage be added to the roots: When the sheep are intended to be sold, two feeds of corn given them for a fortnight, in the intervals of their meals of roots, would harden both their flesh and their talrow.

"It was not sufficient to prove the possibility of fattening sheep with different kinds of roots; it was farther necessary to ascertain the qualities which their flesh might acquire, by the use of them. Four sheep, fed upon the four regimens, were killed the same day; there was indeed some trifling difference in the texture of their flesh, but upon the whole the flavour of all was the same. Let us then conclude, that the culture of roots opens to us infinite resources, not only for fattening of sheep, but also of beasts; and we do not doubt of their being used to the greatest advantage in bringing up cattle in the countries where they are bred.

"The knowledge of these experiments must induce farmers to adopt this culture, since it is so advantageous. Roots cannot be exported; corn, on the contrary, is exported; and the grower may sell the roots instead of consuming them. One acre of roots is equal to five acres of corn. By this means he multiplies his land, and may consequently multiply his cattle and his dung-hill: added to this, roots are not subject, like corn, to the inclemencies of the seasons; the produce is always more certain; these plants being of different natures, it is not likely that they should all fail; the earth is a more faithful depository of our treasures than the atmosphere; the dreadful hurricane of the 15th of this month (July) destroyed every thing but roots; they are the only product which escaped its ravages; if the hail tore their leaves, others will soon shoot; and carrots, beets, turnips, and potatoes, will be safe."

The result of the experiments alluded to is given in the following terms:

EXPERIMENT.

EXPERIMENT upon Fattening Sheep, and their Increase from Month to Month.

Sixteen sheep of the same age, of four different breeds, were picked out of my flock, viz. four the breed of the country, four of Beauce, four of Champagne, and four of Picardy: I weighed them alive, and marked each with a number; I divided them into four lots, and fed them on different sorts of food, as under.

Food.	N ^o	Breeds.	Weights at different Periods.—1788.					Increase each Month.				Total incr. which each food has produced upon four sheep.
			Jan. 20.	Feb 20.	Mar. 20.	April 20.	May 20.	1st M.	2d M.	3d M.	4th M.	
Potatoes,	1	Isle de France,	69 $\frac{1}{2}$ lb.	79 $\frac{1}{2}$ lb.	—	—	—	10lb.	lb.	lb.	lb.	70lb.
	2	Beauce,	70 $\frac{1}{2}$	82 $\frac{1}{2}$	90 $\frac{1}{2}$ lb.	93lb.	95lb.	11 $\frac{1}{2}$	7 $\frac{1}{2}$	2 $\frac{1}{2}$	—	
	3	Champagne,	69 $\frac{1}{2}$	83	82 $\frac{1}{2}$	84	—	13 $\frac{1}{2}$	10 $\frac{1}{2}$	1 $\frac{1}{2}$	—	
	4	Picardy,	88	95	101	—	—	15	6	—	—	
Turnips,	5	Isle de France,	69	86	87	—	—	50 $\frac{1}{2}$	13 $\frac{1}{2}$	4 $\frac{1}{2}$	2	67 $\frac{1}{2}$
	6	Beauce,	71	86	—	—	—	17	1	—	—	
	7	Champagne,	68 $\frac{1}{2}$	78 $\frac{1}{2}$	82 $\frac{1}{2}$	84	84 $\frac{1}{2}$	15	—	—	—	
	8	Picardy,	79	95 $\frac{1}{2}$	97 $\frac{1}{2}$	97 $\frac{1}{2}$	—	10	4	1 $\frac{1}{2}$	$\frac{1}{2}$	
Beets,	9	Isle de France,	72	83 $\frac{1}{2}$	90 $\frac{1}{2}$	94	—	58 $\frac{1}{2}$	7	1 $\frac{1}{2}$	$\frac{1}{2}$	71
	10	Beauce,	70 $\frac{1}{2}$	80 $\frac{1}{2}$	86	—	—	11 $\frac{1}{2}$	7 $\frac{1}{2}$	3 $\frac{1}{2}$	—	
	11	Champagne,	77 $\frac{1}{2}$	90 $\frac{1}{2}$	—	—	—	10	5 $\frac{1}{2}$	—	—	
	12	Picardy,	80	93 $\frac{1}{2}$	98 $\frac{1}{2}$	100 $\frac{1}{2}$	101	13 $\frac{1}{2}$	—	—	—	
Oats, barley, and gray peas.	13	Isle de France,	74	91	95 $\frac{1}{2}$	102	106	48	17 $\frac{1}{2}$	5	$\frac{1}{2}$	92 $\frac{1}{2}$
	14	Beauce,	73 $\frac{1}{2}$	84 $\frac{1}{2}$	91 $\frac{1}{2}$	96	—	17	4 $\frac{1}{2}$	6 $\frac{1}{2}$	4	
	15	Champagne,	71	86 $\frac{1}{2}$	93	—	—	10 $\frac{3}{4}$	7 $\frac{1}{2}$	4 $\frac{1}{2}$	—	
	16	Picardy,	71	77	—	—	—	15 $\frac{1}{2}$	6 $\frac{1}{2}$	—	—	
								16	—	—	—	
								59	18 $\frac{1}{2}$	11	4	

“OBSERVATION. The increase of these sheep, during the first month, being so much more considerable than in the following months, must be attributed to this cause, that lean cattle put up to fatten, eat greedily until they are cloyed, which only fills them, without much increasing their flesh; but, on the contrary, the increase produced in the ensuing months, although apparently less, turns all to profit in flesh and tallow.”

SECT. VI. Of Rabbits.

IN particular situations these animals may be kept to advantage, as they multiply exceedingly, and require no trouble in bringing up. A considerable number of them are kept in Norfolk, where many parts, consisting of barren hills or heaths, are proper for their reception. They delight in the sides of sandy hills, which are generally unproductive when tilled; but level ground is improper for them. Mr Marshall is of opinion, that there are few sandy or other loose-soiled hills which would not pay better in rabbit warrens than any thing else. “The hide of a bullock (says he)

is not worth more than $\frac{1}{20}$ th of his carcase; the skin of a sheep may, in full wool, be worth from a sixth to more than a tenth of its carcase; but the fur of a rabbit is worth twice the whole value of the carcase; therefore supposing a rabbit to consume a quantity of food in proportion to its carcase, it is, on the principle offered, a species of stock nearly three times as valuable as either cattle or sheep. Rabbit warrens ought to be inclosed with a stone or sod wall; and at their first stocking, it will be necessary to form burrows to them until they have time to make them to themselves. Boring the ground horizontally with a large auger is perhaps the best method that can be practised. Eagles, kites, and other birds of prey, as well as cats, weasels, and pole-cats, are great enemies of rabbits. The Norfolk warreners catch the birds by traps placed on the tops of stumps of trees or artificial hillocks of a conical form, on which they naturally alight. Traps also seem to be the only method of getting rid of the other enemies; though thus the rabbits themselves are in danger of being caught.

Rabbits may be fed during the summer with clover and

⁵⁶⁴ Rabbits are more valuable than black cattle or sheep.

⁵⁶⁵ Method of destroying birds of prey.

Poultry.

and other green food, and during the winter with cabbages. Where they are kept in an inclosure as part of the stock of the farm, a practice which has not yet been used in this country, they ought to be fed with great regularity, and with as much as they are willing to take. When this is done, they thrive upon a very moderate quantity of food; but if they are once allowed to suffer hunger in any great degree, they become extremely ravenous, and for a long time can scarcely be satisfied with food. In a communication to the Board of Agriculture from M. Bertrand of Mechlin, in the Netherlands, we are informed that the rabbits of the Angora breed yield in Normandy an uncommonly valuable wool, which serves as a primary material in several considerable manufactures. The Normans assert, that each rabbit yields wool of the value of a crown or six livres. M. Bertrand having discovered that these rabbits are extremely fond of the leaves of the *robinia pseudo-acacia*, (the false acacia), made the following trial of its effects. He fed some females with these leaves only, while to others he gave cabbage leaves and the common food furnished to these animals. He observed that the young ones proceeding from the females fed on the leaves of the *robinia*, grew larger and in less time, and that their coats and wool were finer than on the others fed in the common way. He caused the skins of the indigenous rabbits fed with the robinia leaves to be examined by hat-ters, and they valued them much more than the common ones, asserting that their wool approached in quality to that of hares. The robinia, he observes, thrives on barren heaths. Its branches and leaves are remarkably numerous. Its leaves may be converted into hay, which rabbits and other animals devour eagerly. One person is able to cut a sufficient quantity of branches for a great number of rabbits; and turnips, vetches, beans, and other vegetables, can be sown under the trees.

SECT. VII. Poultry.

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Poultry ought to be confined.

POULTRY, if rightly managed, might be a source of great profit to the farmer; but where many are kept, they ought not to be allowed to go at large, in which case little profit can be expected from them, for not only will many of their eggs be lost, and many of themselves perhaps destroyed by vermine, but at certain seasons they do a great deal of mischief both in the barn-yard and in the field. No doubt they pick up some grain at the barn-doors that might otherwise be lost; but if the straw is properly threshed and shaken, there would be very little of this. In the common careless way of threshing, a great deal of corn is undoubtedly thrown out among the straw; but when we consider the dung of the fowls and their feathers that get among it, and the injury these must do to the cattle, this is no object. It is much better to allow the poultry a certain quantity of food, and to let the cattle have the benefit of what corn may remain among the straw.

Poultry ought therefore always to be confined, but not in a close, dark, diminutive hovel, as is often the case; they should have a spacious airy place properly constructed for them. Some people are of opinion that each sort of poultry should be kept by itself.

This, however, is not absolutely necessary; for all sorts may be kept promiscuously together, provided they have a place sufficiently large to accommodate them conveniently, and proper divisions and nests for each kind to retire to separately, which they will naturally do of themselves.

This method is practised with great success at Mr Wakefield's, near Liverpool, who keeps a large stock of turkeys, geese, hens, and ducks, all in the same place; and although young turkeys are in general considered so difficult to bring up, he rears great numbers of them in this manner every season with little or no trouble whatever. He has about three quarters or near a whole acre inclosed with a fence only six or seven feet high, formed of slabs set on end, or any thinnings of fir or other trees split and put close together. They are fastened by a nail near the top and another near the bottom, and are pointed sharp, which I suppose prevents the poultry flying over, for they never attempt it although so low. Within this fence are places done up slightly (but well secured from wet) for each sort of poultry; also a pond or stream of water running through it. These poultry are fed almost entirely with potatoes boiled in steam, and thrive astonishingly well. The quantity of dung that is made in this poultry-place is also an object worth attention; and when it is cleared out, a thin paring of the surface is at the same time taken off, which makes a valuable compost.

It is generally understood that a full-grown hen continues in her prime for three years, and that during that period, if properly fed, she will lay at a medium 200 eggs every year. The number, however, of eggs may be greatly increased by making the place to which this kind of poultry retire at night very warm and comfortable, by its being placed contiguous to a wall on the other side of which a fire is kept, or by its being heated in any other manner. In the cottages of the poor in Scotland, where the poultry and the inhabitants sleep under the same roof, the hens continue with a moderate portion of food to produce eggs during the greatest part of the winter.

In Norfolk a great number of turkeys are bred, of a size and quality superior to those in other parts. Mr Marshall accounts for their number in the following manner: "It is understood in general, that to rear turkeys with success, it is necessary that a male bird should be kept upon the spot to impregnate the eggs singly; but the good housewives of this country know, that a daily intercourse is unnecessary; and that if the hen be sent to a neighbouring cock previous to the season of exclusion, one act of impregnation is sufficient for one brood. Thus relieved from the expence and disagreeableness of keeping a male bird, most little farmers, and many cottagers, rear turkeys. This accounts for their number; and the species and the food they are fattened with (which, I believe, is wholly buck) account for their superior size and quality."

The following account of the Lincolnshire management of geese is given by Mr John Foote of Bransford, in the Annals of Agriculture. "It is generally allowed, that three geese to one gander is sufficient; more geese would be too many, so as to render the eggs abortive. The quantity of eggs to every goose for sitting about 12 or 13. They must be fed with corn

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"Their nests should be made for them of straw, and confined so as the eggs cannot roll out when the geese turn them, which they do every day.

"When near hatching, the shell should be broke a little against the beak or bill of the gosling, to give air, or to enable it to receive strength to throw off the shell at a proper time. The method of plucking them about the beginning of April is this: Pluck gently and carefully the fine feathers of their breast and back; but be careful not to pull or interrupt their down or pen feathers.

"You also pull their quills, five out of a wing; but I think four would be better. The quills will bear pulling in 13 or 14 weeks again, twice in a year; the feathers three times a year, of the old geese and ganders, seven weeks from the first pulling; and then again seven weeks after, which is the last pulling of the year.

"The young geese may be pulled once at 13 or 14 weeks old, but not quilled, being hatched in March.

"If the geese are late in hatching, I expect the brood geese should not be plucked so soon as April, but the month after.

"If they are fed with barley and oats, as they ought to be, they will thrive and do the better, and their feathers will grow the faster, and better in quality; they must have plenty of grass and water.

"Although persons not acquainted with the management of geese, as above described, may think it inhuman; yet I am credibly informed, they will do better than where they do not pluck them, if they are properly done, as they lose their feathers by moulting, and would not be so healthy.

"It is proved, that by annually plucking geese, as in Lincolnshire, there is saved, by the increase of feathers, many hundred pounds value, which other countries waste, through a mistaken opinion, as not an object worth their attention. Goose feathers are now sold at 18s. a stone, that used about 25 years ago to be bought at 10s. or 11s. in that county.

"A goose will produce by this method about 1s. 6d. annually of good feathers and quills."

SECT. VIII. *Of the Management of the Dairy.*

IN all but the richest corn countries, this is a most important branch of the business of a husbandman. It includes not only the proper method of preserving milk in a wholesome and uncorrupted state, but also the manufacturing from it the two valuable articles of butter and cheese. We shall first consider the subject of the dairy in a general manner; after which we shall take notice of the mode of preparing butter and cheese.

Dr James Anderson remarks, that when a dairy is established, the undertaker may sometimes think it his interest to obtain the greatest possible quantity of produce; sometimes it may be more beneficial for him to have it of the finest quality; and at other times it may be necessary to have both these objects in view, the one or the other in a greater or less proportion; it is therefore of importance that he should know how he may

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accomplish the one or the other of these purposes in the easiest and most direct manner.

To be able to convert his milk to the highest possible profit in every case, he ought to be fully acquainted with every circumstance respecting the manufacture both of butter and of cheese; as it may in some cases happen, that a certain portion of that milk may be more advantageously converted into butter than into cheese, while another portion of it would return more profit if made into cheese.

The first thing to be adverted to, in an undertaking of this nature, is to choose cows of a proper sort. Among this class of animals, it is found by experience, that some kinds give milk of a much thicker consistence, and richer quality, than others; nor is this richness of quality necessarily connected with the smallness of the quantity yielded by cows of nearly an equal size; it therefore behoves the owner of a dairy to be peculiarly attentive to this circumstance. In judging of the value of a cow, it ought rather to be the quantity and the quality of the cream produced from the milk of the cow, in a given time, than the quantity of the milk itself: this is a circumstance that will be shewn hereafter to be of more importance than is generally imagined. The small cows of the Alderney breed afford the richest milk hitherto known; but individual cows in every country may be found, by a careful selection, that afford much thicker milk than others; these therefore ought to be searched for with care, and their breed reared with attention, as being peculiarly valuable.

Few persons, who have had any experience at all in the dairy, can be ignorant, however, that in comparing the milk of two cows, to judge of their respective qualities, particular attention must be paid to the time that has elapsed since their calving; for the milk of the same cow is always thinner soon after calving than it is afterwards; as it gradually becomes thicker, though generally less in quantity, in proportion to the time since the cow has calved. The colour of the milk, soon after calving, is richer than it is afterwards; but this, especially for the first two weeks, is a faulty colour, that ought not to be coveted.

To make the cows give abundance of milk, and of a good quality, they must at all times have plenty of food. Grass is the best food yet known for this purpose, and that kind of grass which springs up spontaneously on rich dry soils is the best of all. If the temperature of the climate be such as to permit the cows to graze at ease throughout the day, they should be suffered to range on such pastures at freedom; but if the cows are so much incommoded by the heat as to be prevented from eating throughout the day, they ought in that case to be taken into cool sheds for protection; where, after allowing them a proper time to ruminate, they should be supplied with abundance of green food, fresh-cut for the purpose, and given to them by hand frequently, in small quantities, fresh and fresh, so as to induce them to eat it with pleasure. When the heat of the day is over, and they can remain abroad with ease, they may be again turned into the pasture, where they should be allowed to range with freedom all night, during the mild weather of summer.

Cows, if abundantly fed, should be milked three times a day during the whole of the summer season; in the morning early, at noon, and in the evening, just before

Management of the Dairy. night-fall. In the choice of persons for milking the cows, great caution should be employed; for if that operation be not carefully and properly performed, not only the quantity of the produce of the dairy will be greatly diminished, but its quality also will be very much debased; for if all the milk be not thoroughly drawn from a cow when she is milked, that portion of milk which is left in the udder seems to be gradually absorbed into the system, and nature generates no more than to supply the waste of what has been taken away. If this lessened quantity be not again thoroughly drawn off, it occasions a yet further diminution of the quantity of milk generated; and thus it may be made to proceed, in perpetual progression from little to less, till none at all is produced. In short, this is the practice in all cases followed, when it is meant to allow a cow's milk to dry up entirely, without doing her hurt. In this manner, therefore, the profits of a dairy might be wonderfully diminished; so that it much behoves the owner of it to be extremely attentive to this circumstance, if he wishes to avoid ruin. It ought to be a rule without an exception, never to allow this important department to be entrusted, without controul, to the management of hired servants. Its importance will be still more manifest from the following aphorisms.

Aphorism 1. "Of the milk that is drawn from any cow at one time, that which comes off at the first is always thinner, and of a much worse quality, than that which comes afterwards; and the richness goes on continually increasing to the very last drop that can be drawn from the udder at that time."

Few persons are ignorant that the milk which is last of all taken from the cow at milking (in this country called *stroakings*) is richer than the rest of the milk; but fewer still are aware of the greatness of the disproportion between the quality of the first and the last drawn milk, from the same cow, at one milking. The following facts (says our author) respecting this circumstance were ascertained by me many years ago, and have been confirmed by many subsequent experiments and observations.

Having taken several large tea-cups, exactly of the same size and shape, one of these tea-cups was filled at the beginning of the milking, and the others at regular intervals, till the last, which was filled with the dregs of the stroakings. These cups were then weighed, the weight of each having been settled, so as to ascertain that the quantity of milk in each was precisely the same; and from a great number of experiments frequently repeated with many different cows, the result was in all cases as follows:

First, The quantity of cream obtained from the first-drawn cup was, in every case, much smaller than from that which was last drawn; and those between afforded less or more as they were nearer the beginning or the end. It is unnecessary here to specify these intermediate proportions; but it is proper the reader should be informed that the quantity of cream obtained from the last-drawn cup, from some cows, exceeded that from the first in the proportion of sixteen to one. In other cows, however, and in particular circumstances, the disproportion was not quite so great; but in no case did it fall short of the rate of eight to one. Probably, upon an average of a great many cows, it might be found to run as ten or twelve to one.

Secondly, The difference in the quality of the cream, however, obtained from these two cups, was much greater than the difference in the quantity. In the first cup, the cream was a thin tough film, thinner, and perhaps whiter, than writing paper; in the last, the cream was of a thick *butyrous* consistence, and of a glowing richness of colour that no other kind of cream is ever found to possess.

Thirdly, The difference in the quality of the milk that remained, after the cream was separated, was perhaps still greater than either in respect to the quantity or the quality of the cream. The milk in the first cup was a thin bluish liquid, as if a very large proportion of water had been mixed with ordinary milk; that in the last cup was of a thick consistence, and yellow colour, more resembling cream than milk both in taste and appearance.

From this important experiment, it appears that the person who, by bad milking of his cows, loses but half a pint of his milk, loses in fact about as much cream as would be afforded by six or eight pints of the beginning, and loses, besides, that part of the cream which alone can give richness and high flavour to his butter.

Aphorism 2. "If milk be put into a dish, and allowed to stand till it throws up cream, that portion of cream which rises first to the surface is richer in quality, and greater in quantity, than what rises in a second equal space of time; and the cream that rises in the second interval of time is greater in quantity, and richer in quality, than that which rises in a third equal space of time; that of the third than the fourth, and so on: the cream that rises decreasing in quantity, and declining in quality, continually, as long as any rises to the surface."

Our ingenious author confesses, that his experiments not having been made with so much accuracy in this case as in the former, he was not enabled to ascertain the difference in the proportion that takes place in equal portions of time; but they have been so often repeated as not to leave any room to doubt the fact, and it will be allowed to be a fact of no small importance in the management of the dairy. It is not certain, however, but that a greater quantity of cream may, upon the whole, be obtained from the milk by taking it away at different times: but the process is so troublesome as not to be counterbalanced by the increased quantity obtained, if indeed an increased quantity be thus obtained, which is not as yet quite certain.

Aphorism 3. "Thick milk always throws up a smaller proportion of the cream it actually contains, to the surface, than milk that is thinner; but that cream is of a richer quality. If water be added to that thick milk, it will afford a considerably greater quantity of cream than it would have done if allowed to remain pure, but its quality is, at the same time, greatly debased."

This is a fact that every person attentive to a dairy must have remarked; but I have never (says our author) heard of any experiment that could ascertain, either the precise amount of the increased quantity of cream that might thus be obtained, or of the ratio in the decrease of its quality. The effects of mixing water with the milk in a dairy are at least ascertained; and the knowledge of the fact will enable attentive persons to follow that practice which they think will best promote their own interest.

Aphorism 4. "Milk which is put into a bucket or other

Management of the Dairy. other proper vessel, and carried in it to any considerable distance, so as to be much agitated, and in part cooled, before it be put into the milk-pans to settle for cream, never throws up so much, nor so rich cream, as if the same milk had been put into the milk-pans directly after it was milked."

In this case, it is believed the loss of cream will be nearly in proportion to the time that has elapsed, and the agitation the milk has sustained, after being drawn from the cow. But Dr Anderson says that he is not yet in possession of any experiments which sufficiently ascertain how much is to be ascribed to the time, and the agitation, taken separately. On every branch of agriculture we find experiments wanting, at each step we advance in our inquiries; and it is the duty of every inquirer to point out, as he goes along, where they are wanted, since the labours of no one man can possibly complete the whole.

From the above facts, the following corollaries seem to be clearly deducible:

First, It is of importance that the cows should be always milked as near the dairy as possible, to prevent the necessity of carrying and cooling the milk before it is put into the dishes; and as cows are much hurt by far driving, it must be a great advantage in a dairy-farm to have the principal grass fields as near the dairy or homestead as possible.

Secondly, The practice of putting the milk of all the cows of a large dairy into one vessel, as it is milked, there to remain till the whole milking is finished, before any part of it is put into the milk-pans—seems to be highly injudicious; not only on account of the loss that is sustained by agitation and cooling, but also, more especially, because it prevents the owner of the dairy from distinguishing the good from the bad cow's milk, so as to separate these from each other, where it is necessary. He may thus have the whole of his dairy product greatly debased by the milk of one bad cow, for years together, without being able to discover it. A better practice, therefore, will be, to have the milk drawn from each cow put separately into the creaming-pans as soon as it is milked, without being ever mixed with any other. Thus would the careful manager of the dairy be able on all occasions to observe the particular quality of each individual cow's milk, as well as its quantity, and to know with precision which of his cows it was his interest to dispose of, and which of them he ought to keep and breed from.

Thirdly, If it be intended to make butter of a very fine quality, it will be advisable in all cases to keep the milk that is first drawn separate from that which comes last; as it is obvious, that if this be not done, the quality of the butter will be greatly debased, without much augmenting its quantity. It is also obvious, that if this is done, the quality of the butter will be improved in proportion to the smallness of the quantity of the first drawn milk that is retained; so that those who wish to be singularly nice in this respect, will do well to retain only a very small portion of the first drawn milk.

To those owners of dairies who have profit only in view, it must ever be a matter of trial and calculation, how far it is expedient for them to carry the improving of the quality of their butter at the expence of diminishing its quantity. In different situations prudence will point out different kinds of practice as most eli-

gible; and all persons must be left, after making accurate trials, to determine for themselves. It is likewise a consideration of no small importance, to determine in what way the inferior milk, that is thus to be set apart where fine butter is wanted, can be employed with the greatest profit. In the Highlands of Scotland they have adopted, without thinking of the improvement of their butter, a very simple and economical practice in this respect. As the rearing of calves is there a principal object with the farmer, every cow is allowed to suckle her own calf with a part of her milk, the remainder only being employed in the dairy. To give the calf its portion regularly, it is separated from the cow, and kept in an inclosure, with all the other calves belonging to the same farm. At regular times, the cows are driven to the door of the inclosure, where the young calves fail not to meet them. Each calf is then separately let out, and runs directly to its mother, where it sucks till the dairy-maid judges it has had enough; she then orders it to be driven away, having previously shackled the hinder legs of the mother, by a very simple contrivance, to oblige her to stand still. Boys drive away the calf with switches, and return it to the inclosure, while the dairy-maid milks off what was left by the calf: thus they proceed till the whole of the cows are milked. They obtain only a small quantity of milk, it is true, but that milk is of an exceeding rich quality; which, in the hands of such of the inhabitants as know how to manage it, is manufactured into the richest marrowy butter that can be anywhere met with. This richness of the Highland butter is universally ascribed to the old grass the cows feed upon in their remote glens; but it is in fact chiefly to be attributed to the practice here described, which has long prevailed in those regions. Whether a similar practice could be economically adopted elsewhere, our author takes not upon him to say; but doubtless other secondary uses might be found for the milk of inferior quality. On some occasions, it might be converted into butter of an inferior quality; on other occasions, it might be sold sweet, where the situation of the farm was within reach of a market town; and on others, it might be converted into cheeses, which, by being made of sweet milk, would be of a very fine quality if carefully made. Still other uses might be devised for its application; of which the following is worthy of notice. Take common skimmed milk, when it has begun to turn sour, put it into an upright stand-churn, or a barrel with one of its ends out, or any other convenient vessel. Heat some water, and pour it into a tub that is large enough to contain with ease the vessel into which the milk was put. Set the vessel containing the milk into the hot water, and let it remain there for the space of one night. In the morning it will be found that the milk has separated into two parts; a thick cream-like substance, which occupies the upper part of the vessel, and a thin watery part that remains at the bottom. Draw off the thin part (called in Scotland *wigg*) by opening a stop-cock, placed for that purpose close above the bottom, and reserve the cream for use. Not much less than half of the milk is thus converted into a sort of cream, which, when well made, seems to be as rich and fat as real cream itself, and is only distinguished from it by its sourness. It is eaten with sugar, and esteemed a great delicacy, and usually sells at double the price

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of fresh unskimmed milk. It requires practice, however to be able to make this nicely; the degree of the heat of the water, and many other circumstances, greatly affecting the operation.

Fourthly, If the quality of the butter be the chief object attended to, it will be necessary, not only to separate the first from the last drawn milk, but also to take nothing but the cream that is first separated from the best milk, as it is this first rising cream alone that is of the prime quality. The remainder of the milk, which will be still sweet, may be either employed for the purpose of making sweet-milk cheeses, or may be allowed to stand, to throw up cream for making butter of an inferior quality, as circumstances may direct.

Fifthly, From the above facts, we are enabled to perceive, that butter of the very best possible quality can only be obtained from a dairy of considerable extent, judiciously managed; for when only a small portion of each cow's milk can be set apart for throwing up cream, and when only a small proportion of that cream can be reserved, of the prime quality, it follows (the quantity of milk being upon the whole very inconsiderable), that the quantity of prime cream produced would be so small as to be scarcely worth manufacturing separately.

Sixthly, From these premises we are also led to draw another conclusion, extremely different from the opinion that is commonly entertained on this subject, viz. That it seems probable, that the very best butter could be made with economy in those dairies only where the manufacture of cheese is the principal object. The reasons are obvious: If only a small portion of milk should be set apart for butter, all the rest may be made into cheese, while it is yet warm from the cow, and perfectly sweet; and if only that portion of cream which rises during the first three or four hours after milking is to be reserved for butter, the rich milk which is left after that cream is separated, being still perfectly sweet, may be converted into cheese with as great advantage nearly as the newly-milked milk itself.

But as it is not probable that many persons could be found who would be willing to purchase the very finest butter, made in the manner above pointed out, at a price that would be sufficient to indemnify the farmer for his trouble in making it, these hints are thrown out merely to shew the curious in what way butter possessing this superior degree of excellence may be obtained, if they choose to be at the expence; but for an ordinary market, Dr Anderson is satisfied, from experience and attentive observation, that if in general about the first drawn half of the milk be separated at each milking, and the remainder only set up for producing cream, and if that milk be allowed to stand to throw up the whole of its cream (even till it begins sensibly to taste sourish), and that cream be afterwards carefully managed, the butter thus obtained will be of a quality greatly superior to what can usually be procured at market, and its quality not considerably less than if the whole of the milk had been treated alike. This, therefore, is the practice that he thinks most likely to suit the frugal farmer, as his butter, though of a superior quality, could be afforded at a price that would always ensure it a rapid sale.

Our author now proceeds to enumerate the properties of a dairy. The milk-house ought to be cool in

summer and warm in winter; so that an equal temperature may be preserved throughout the year. It ought also to be dry, so as to admit of being kept sweet and clean at all times. A separate building should be erected for the purpose, near a cool spring or running water, where the cows may have easy access to it, and where it is not liable to be incommoded by stagnant water. The apartment where the milk stands should be well thatched, have thick walls, and a ventilator in the top for admitting a free circulation of air. There should also be an apartment with a fire-place and caldron, for the purpose of scalding and cleaning the vessels. The doctor is of opinion, that the temperature of from 50 to 55 degrees is the most proper for separating the cream from the milk, and by proper means this might easily be kept up, or nearly so, both summer and winter.

The utensils of the dairy should be all made of wood, in preference either to lead, copper, or even cast iron. These metals are all very easily soluble in acids; the solutions of the two first highly poisonous; and though the latter is innocent, the taste of it might render the products highly disagreeable.

Butter, though used at present as food in most countries of Europe, was not known, or known very imperfectly, to the ancients. This, we think, is completely proved by Professor Beckmann in the second volume of his *History of Inventions*. In our translation of the Hebrew Scripture, there is indeed frequent mention made of butter at very early periods; but, as the Professor well observes, the greatest masters of biblical criticism unanimously agree, that the word so translated signifies milk or cream, or sour thick milk, and cannot possibly mean what we call *butter*. The word plainly alludes to something liquid, which was used for washing the feet, which was drunk, and which had sometimes the power of intoxicating; and we know that mares milk may be so prepared as to produce the same effect. See KOUMISS.

The oldest mention of butter, the Professor thinks, is in the account of the Scythians given by Herodotus (lib. iv. 2.), who says, that "these people pour the milk of their mares into wooden vessels, cause it to be violently stirred or shaken by their blind slaves, and separate the part which arises to the surface, as they consider it as more valuable and delicious than what is collected below it." That this substance must have been a soft kind of butter, is well known; and Hippocrates gives a similar account of Scythian butter, and calls it *πιμασιον*, which Galen translates by the word *βοδύγεον*. The poet Anaxandrides, who lived soon after Hippocrates, describing the marriage-feast of Iphicrates, who married the daughter of Cotys king of Thrace, says, that the Thracians ate butter, which the Greeks at that time considered as a wonderful kind of food.

Dioscorides says, that good butter was prepared from the fattest milk, such as that of sheep or goats, by shaking it in a vessel till the fat was separated. To this butter he ascribes the same effects, when used externally, as those produced by our butter at present. He adds also, and he is the first writer who makes the observation, that fresh butter might be melted and poured over pulse and vegetables instead of oil, and that it might be employed in pastry in the room of other fat substances.

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scribed.

substances. A kind of soot likewise was at that time prepared from butter for external applications, which was used in curing inflammation of the eyes and other disorders. For this purpose the butter was put into a lamp, and when consumed, the lamp was again filled till the desired quantity of soot was collected in a vessel placed over it.

Galen, who distinguishes and confirms in a more accurate manner the healing virtues of butter, expressly remarks, that cows milk produces the fattest butter; that butter made from sheep's or goats milk is less rich; and that asses milk yields the poorest. He expresses his astonishment, therefore, that Dioscorides should say that butter was made only from the milk of sheep and goats. He assures us that he had seen it made from cows milk, and that he believes it had thence acquired its name. "Butter (says he) may be very properly employed for ointments; and when leather is besmeared with it, the same purpose is answered as when it is rubbed over with oil. In cold countries, which do not produce oil, butter is used in the baths; and that it is a real fat, may be readily perceived by its catching fire when poured over burning coals." What has been here said is sufficient to shew that butter must have been very little known to or used by the Greeks and Romans in the time of Galen, that is, at the end of the second century.

The professor having collected, in chronological order, every thing which he could find in the works of the ancients respecting butter, concludes, that it is not a Grecian, and much less a Roman invention, but that the Greeks were made acquainted with it by the Scythians, the Thracians, and the Phrygians, and the Romans by the people of Germany. He is likewise decidedly of opinion, that when these two polished nations had learnt the art of making it, they used it not as food, but only as an ointment, or sometimes as a medicine. "We never find it (says he) mentioned by Galen and others as a food, though they have spoken of it as applicable to other purposes. No notice is taken of it by Apicius; nor is there any thing said of it in that respect by the authors who treat on agriculture, though they have given us very particular information concerning milk, cheese, and oil."

The ancient Christians of Egypt burnt butter in their lamps instead of oil; and in the Roman churches, it was anciently allowed, during Christmas time, to burn butter instead of oil, on account of the great consumption of it otherwise.

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butter.

Butter is the fat, oily, and inflammable part of the milk. This kind of oil is naturally distributed through all the substance of the milk in very small particles; which are interposed betwixt the caseous and serous parts, amongst which it is suspended by a slight adhesion, but without being dissolved. It is in the same state in which oil is in emulsions: hence the same whiteness of milk and emulsions; and hence, by rest, the oily parts separate from both these liquors to the surface, and form a cream. See EMULSION.

When butter is in the state of cream, its proper oily parts are not yet sufficiently united together to form a homogeneous mass. They are still half separated by the interposition of a pretty large quantity of serous and caseous particles. The butter is completely formed by pressing out these heterogeneous parts by means

of continued percussion. It then becomes an uniform soft mass.

Fresh butter, which has undergone no change, has scarcely any smell; its taste is mild and agreeable, it melts with a weak heat, and none of its principles are disengaged by the heat of boiling water. Those properties prove, that the oily part of butter is of the nature of the fat, fixed, and mild oils obtained from many vegetable substances by expression. See OILS.—The half fluid consistence of butter, as of most other concrete oily matters, is thought to be owing to a considerable quantity of acid united with the oily part; which acid is so well combined, that it is not perceptible while the butter is fresh, and has undergone no change; but when it grows old, and undergoes some kind of fermentation, then the acid is disengaged more and more; and this is the cause that butter, like oils of the same kind, becomes rancid by age.

Butter is constantly used in food, from its agreeable taste; but to be wholesome, it must be very fresh and free from rancidity, and also not fried or burnt; otherwise its acrid and even caustic acid, being disengaged, disorders digestion, renders it difficult and painful, excites acrid empyreumatic belchings, and introduces much acrimony into the blood. Some persons have stomachs so delicate, that they are even affected with these inconveniences by fresh butter and milk. This observation is also applicable to oil, fat, chocolate, and in general to all oleaginous matters.

Dr James Anderson, whom we have already quoted, gives the following minute directions for making and preserving butter. The creaming dishes, when properly cleaned, sweet, and cool, ought to be filled with the milk as soon as it is drawn from the cow, having been first carefully strained through a cloth, or close strainer made of hair or wire: the doctor prefers silver wire to every other. The creaming dishes ought never to exceed three inches in depth; but they may be so broad as to contain a gallon and a half; when filled they ought to be put on the shelves of the milk-house, and remain there until the cream be fully separated. If the finest butter be intended, the milk ought not to stand above six or eight hours, but for ordinary butter it may stand 12 hours or more; yet if the dairy be very large, a sufficient quantity of cream will be separated in two, three, or four hours, for making the best butter. It is then to be taken off as nicely as possible by a skimming dish, without lifting any of the milk; and immediately after put into a vessel by itself, until a proper quantity for churning be collected. A firm, neat, wooden barrel seems well adapted for this purpose, open at one end, and having a lid fitted to close it. A cock or spigot ought to be fixed near the bottom, to draw off any thin or serous part which may drain from the cream; the inside of the opening should be covered with a bit of fine silver wire gauze, in order to keep back the cream while the serum is allowed to pass; and the barrel should be inclined a little on its stand, to allow the whole to run off.

The doctor contradicts the opinion that very fine Cream butter cannot be obtained, except from cream that is ought to be kept not above a day old. On the contrary, he insists that it is only in very few cases that even tolerably good butter can be obtained from cream that is not above one day old. The separation of butter from cream

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some time
before it be
made into
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Management of the Dairy. only takes place after the cream has attained a certain degree of acidity. If it be agitated before that acidity has begun to take place, no butter can be obtained, and the agitation must be continued till the time that the sourness is produced; after which the butter begins to form. "In summer, while the climate is warm, the beating may be, without very much difficulty, continued until the acidity be produced, so that butter may be got: but in this case the process is long and tedious; and the butter is for the most part of a soft consistence, and tough and gluey to the touch. If this process be attempted during the cold weather in winter, butter can scarcely be in any way obtained, unless by the application of some great degree of heat, which sometimes assists in producing a very inferior kind of butter, white, hard, and brittle, and almost unfit for any culinary purpose whatever. The judicious farmer, therefore, will not attempt to imitate this practice, but will allow his cream to remain in the vessel appropriated for keeping it, until it has acquired the proper degree of acidity. There is no rule for determining how long it is to be kept; but our author is of opinion, that a very great latitude is allowable in this case; and that if no serious matter be allowed to lodge among the cream, it may be kept good for making butter a great many weeks.

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churn.

The churn in which butter is made likewise admits of considerable diversity; but our author prefers the old-fashioned upright churn to all others, on account of its being more easily cleaned. The labour, when the cream is properly prepared, he thinks, very trifling. Much greater nicety, he says, is required in the process of churning than most people are aware of; as a few hasty and irregular strokes will render butter bad, which otherwise would have been of the finest quality. After the process is over, the whole ought to be separated from the milk, and put into a clean dish, the inside of which, if made of wood, ought to be well rubbed with common salt, to prevent the butter from adhering to it. The butter should be pressed and worked with a flat wooden ladle or skimming dish, having a short handle, so as to force out all the milk that was lodged in the cavities of the mass. This operation requires a considerable degree of strength as well as dexterity; but our author condemns the beating up of the butter with the hand as "an indelicate and barbarous practice." In like manner he condemns the employing of cold water in this operation, to wash the butter as it is called. Thus, he says, the quality of it is debased in an astonishing degree. If it is too soft, it may be put into small vessels, and these allowed to swim in a tub of cold water: but the water ought never to touch the butter. The beating should be continued till the milk be thoroughly separated, but not till the butter become tough and gluey; and after this is completely done, it is next to be salted. The vessel into which it is to be put must be well seasoned with boiling water several times poured into it: the inside is to be rubbed over with common salt, and a little melted butter poured into the cavity between the bottom and sides so as to make it even with the bottom; and it is then fit for receiving the butter. Instead of common salt alone, the doctor recommends the following composition. "Take of sugar one part, of nitre one part, and of the best Spanish great salt, two parts. Beat the

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ought not
to be put
into water.

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for preserv-
ing butter.

whole into a fine powder, mix them well together, and put them by for use. One ounce of this is to be thoroughly mixed with a pound of butter as soon as it is freed from the milk, and then immediately put into the vessel designed to hold it; after which it must be pressed so close as to leave no air-holes; the surface is to be smoothed and covered with a piece of linen, and over that a piece of wet parchment; or, in defect of this last, fine linen that has been dipped in melted butter, exactly fitted to the edges of the vessel all round, in order to exclude the air as much as possible. When quite full, the cask is to be covered in like manner, and a little melted butter put round the edges, in order to fill up effectually every cranny, and totally to exclude the air. "If all this (says the doctor) be carefully done, the butter may be kept perfectly sound in this climate for many years. How many years I cannot tell; but I have seen it two years old, and in every respect as sweet and sound as when only a month old. It deserves to be remarked, that butter cured in this manner does not taste well till it has stood at least a fortnight after being salted; but after that period is elapsed, it eats with a rich marrowy taste that no other butter ever acquires; and it tastes so little salt, that a person who had been accustomed to eat butter cured with common salt only, would not imagine it had got one-fourth part of the salt necessary to preserve it." Our author is of opinion, that strong brine may be useful to pour upon the surface during the time it is using, in order the more effectually to preserve it from the air, and to avoid rancidity.

As butter contains a quantity of mucilaginous matter, much more putrescible than the pure oily part, our author recommends the purifying it from this mucilage by melting in a conical vessel, in which the mucilage will fall to the bottom; the pure oily part swimming at top. This will be useful when butter is to be sent a long voyage to warm climates, as the pure part will keep much better than when mixed with the other. He proposes another method of preserving butter, viz. by mixing it with honey, which is very antiseptic, and mixes intimately with the butter. Thus mixed, it eats very pleasantly, and may perhaps be successfully used with a medicinal intention.

In England no butter is esteemed equal to that which is made in the county of Essex, well known by the name of Epping butter, and which in every season of the year yields at London a much higher price than any other. The following directions concerning the making and management of butter, including the Epping method, are extracted from the 3d volume of the Bath Society Papers.

In general it is to be observed, that the greater the quantity made from a few cows, the greater will be the farmer's profit: therefore he should never keep any but what are esteemed good milkers. A bad cow will be equally expensive in her keep, and will not perhaps (by the butter and cheese that is made from her) bring in more than from three to six pounds a-year; whereas a good one will bring from seven to ten pounds *per annum*: therefore it is obvious that bad cows should be parted with, and good ones purchased in their room. When such are obtained, a good servant should be employed to milk them; as through the neglect and mismanagement of servants, it frequently happens that the

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butter for
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Management of the Dairy. the best cows are spoiled. No farmer should trust entirely to servants, but sometimes see themselves that their cows are milked clean; for if any milk is suffered to remain in the udder, the cow will daily give less, till at length she will become dry before the proper time, and the next season she will scarce give milk sufficient to pay for her keep.

It sometimes happens that some of a cow's teats may be scratched or wounded so as to produce foul or corrupted milk; when this is the case, we should by no means mix it with the sweet milk, but give it to the pigs; and that which is conveyed to the dairy-house should remain in the pail till it is nearly cool, before it be strained, that is, if the weather be warm; but in frosty weather, it should be immediately strained, and a small quantity of boiling water may be mixed with it, which will cause it to produce cream in abundance, and the more so if the pans or vats have a large surface.

During the hot summer months, it is right to rise with or before the sun, that the cream may be skimmed from the milk ere the dairy becomes warm; nor should the milk, at that season, stand longer in the vats, &c. than 24 hours, nor be skimmed in the evening till after sunset. In winter milk may remain unskimmed for 36 or 48 hours. The cream should be deposited in a deep pan, which should be kept during the summer in the coolest part of the dairy; or in a cool cellar where a free air is admitted, which is still better. Where people have not an opportunity of churning every other day, they should shift the cream daily into clean pans, which will keep it cool, but they should never fail to churn at least twice in the week in hot weather; and this work should be done in a morning before the sun appears, taking care to fix the churn where there is a free draught of air. If a pump churn be to be used, it may be plunged a foot deep into a tub of cold water, and should remain there during the whole time of churning, which will very much harden the butter. A strong rancid flavour will be given to butter, if we churn so near the fire as to heat the wood in the winter season.

After the butter is churned, it should be immediately washed in many different waters till it is perfectly cleansed from the milk; but here it must be remarked, that a warm hand will soften it, and make it appear greasy, so that it will be impossible to obtain the best price for it. The cheesemongers use two pieces of wood for their butter; and if those who have a very hot hand were to have such, they might work the butter so as to make it more saleable.

The Epping butter is made up for market in long rolls, weighing a pound each; in the county of Somerset, they dish it in half pounds for sale; but if they forget to rub salt round the inside of the dish, it will be difficult to work it so as to make it appear handsome.

Butter will require and endure more working in winter than in summer; but it is remarked, that no person whose hand is warm by nature makes good butter.

Those who use a pump-churn must endeavour to keep a regular stroke; nor should they admit any person to assist them, except they keep nearly the same stroke: for if they churn more slowly, the butter will

in the winter *go back*, as it is called; and if the stroke be more quick and violent in the summer, it will cause a fermentation, by which means the butter will imbibe a very disagreeable flavour.

Where people keep many cows, a barrel-churn is to be preferred; but if this be not kept very clean, the bad effects will be discovered in the butter; nor must we forget to shift the situation of the churn when we use it, as the seasons alter, so as to fix it in a warm place in winter, and where there is a free air in summer.

In many parts of this kingdom they colour their butter in winter, but this adds nothing to its goodness; and it rarely happens that the farmers in or near Epping use any colour; but when they do, it is very innocent. They procure some sound carrots, whose juice they express through a sieve, and mix with the cream when it enters the churn, which makes it appear like May butter; nor do they at any time use much salt, though a little is absolutely necessary.

As they make in that county but very little cheese, so of course very little whey butter is made; nor indeed should any person make it, except for present use, as it will not keep good more than two days; and the whey will turn to better account to fatten pigs with. Nothing feeds these faster, nor will any thing make them so delicately white; at the same time it is to be observed, that no good bacon can be made from pigs thus fattened. Where much butter is made, good cheese for servants may be obtained from skimmed milk, and the whey will afterwards do for store pigs.

The foregoing rules will suffice for making good butter in any country; but as some people are partial to the west country method, it shall be described as briefly as possible.

In the first place, they deposite their milk in earthen pans in their dairy-house, and (after they have stood twelve hours in the summer, and double that space in the winter) they remove them to stoves made for that purpose, which stoves are filled with hot embers; on these they remain till bubbles rise, and the cream changes its colour; it is then deemed heated enough, and this they call scalded cream; it is afterwards removed steadily to the dairy, where it remains 12 hours more, and is then skimmed from the milk, and put into a tub or churn: if it be put into a tub, it is beat well with the hand, and thus they obtain butter; but a cleaner way is to make use of a churn. Some scald it over the fire, but then the smoke is apt to affect it; and in either case, if the pans touch the fire, they will crack or fly, and the milk and cream will be wasted.

The Cambridgeshire salt butter is held in the highest esteem, and is made nearly after the same method as the Epping; and by washing and working the salt from it, the cheesemongers in London often sell it at a high price for fresh butter. They deposite it when made into wooden tubs or firkins, which they expose to the air for two or three weeks, and often wash them; but a readier way is to season them with unslaked lime, or a large quantity of salt and water well boiled will do; with this they must be scrubbed several times, and afterwards thrown into cold water, where they should remain three or four days, or till they are wanted; then they should be scrubbed as before, and well rinsed with cold water; but before they receive the butter, care

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mode of
making
butter.

Cambridge-
shire but-
ter.

care

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Yorkshire
and Suffolk
butter.

They pursue nearly the same method in Suffolk and Yorkshire; nor is the butter that is made in these counties much inferior to that made in Cambridgeshire; indeed it is often sold in London for Cambridge butter: and no people make more butter from their cows than the Yorkshire farmers do, which is certainly owing to the care they take of their cows in the winter; as at that season they house them all, feed them with good hay, and never suffer them to go out (except to water) but when the weather is very serene; and when their cows calve, they give them comfortable malt meshes for two or three days after; but these cows never answer if they are removed to other counties, except the same care and attendance be given them, and then none answer better.

Land whereon cows feed does very often affect the butter. If wild garlic, charlock, or May-weed, be found in a pasture ground, cows should not feed therein till after they have been mown, when such pernicious plants will appear no more till the following spring; but those cows that give milk must not partake of the hay made therefrom, as that will also diffuse its bad qualities.

Great part of the Epping butter is made from cows that feed during the summer months in Epping Forest, where the leaves and shrubby plants contribute greatly to the flavour of the butter. The mountains of Wales, the highlands of Scotland, and all the moors, commons, and heaths in England, produce excellent butter where it is properly managed; and though not equal in quantity, yet far superior in quality to that which is produced from the richest meadows; and the land is often blamed when the butter is bad through mismanagement, sluttishness, or inattention.

Turnips and rape affect milk and butter, but brewers grains are sweet and wholesome food, and will make cows give abundance of milk; yet the cream thereon will be thin, except good hay be given at the same time, after every meal of grains. Coleworts and cabbages are also excellent foods; and if these and savoys were cultivated for this purpose, the farmers in general would find their account in it.

Cows should never be suffered to drink improper water; stagnated pools, water wherein frogs, &c. spawn, common sewers, and ponds that receive the drainings of stables, are improper.

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Frauds in
the sale of
butter.

Divers abuses are committed in the packing and salting of butter, to increase its bulk and weight, against which we have a statute express. Pots are frequently laid with good butter for a little depth at the top, and with bad at the bottom; sometimes the butter is set in rolls, only touching at top, and standing hollow at bottom. To prevent these cheats, the factors at Utoxeter keep a surveyor, who, in case of suspicion, tries the pots with an iron instrument called a *butter-bore*, made like a cheese-taster, to be stuck in obliquely to the bottom.

In the Annals of Agriculture, vol. xvii. the following mode of preventing butter and cream from receiving a taint from the cows feeding on cabbages and turnips is stated by J. Jones, Esq. of Bolas-leath, Newport, Shropshire. "I find by experience (says he), that a small bit of saltpetre, powdered and put into the milk-pan, with the new milk, does effectually prevent the cream and butter from being tainted, although the cows be fed on the refuse leaves of cabbages and turnips. In the beginning of this last winter, my men were very careful in not giving to the cows any outside or decayed leaves of the cabbages or turnips; yet the cream and butter were sadly tainted: but as soon as the maid used the saltpetre, all the taint was done away; and afterwards no care was taken in feeding the cows, for they had cabbages and turnips in all states. Our milk-pans hold about nine pints of milk."

The trade in butter is very considerable. Some compute 50,000 tons annually consumed in London. It is chiefly made within 40 miles round the city. Fifty thousand firkins are said to be sent yearly from Cambridge and Suffolk alone; each firkin containing 56 lbs. Utoxeter, in Staffordshire, is a market famous for good butter, inasmuch, that the London merchants have established a factory there for that article. It is bought by the pot, of a long cylindrical form, weighing 14 lbs.

The other grand object of the dairy is cheese-making. Cheese is the curd of milk, precipitated or separated from the whey by an acid. Cheese differs in quality according as it is made from new or skimmed milk, from the curd which separates spontaneously upon standing, or that which is more speedily produced by the addition of rennet. Cream also affords a kind of cheese, but quite fat and butyraceous, and which does not keep long. Analyzed chemically, cheese appears to partake much more of an animal nature than butter, or the milk from which it was made. It is insoluble in every liquid except spirit of nitre, and caustic alkaline ley. Shaved thin, and properly treated with hot water, it forms a very strong cement if mixed with quicklime*. When prepared with the hot water, it is recommended in the Swedish Memoirs to be used by anglers as a bait. It may be made into any form, is not softened by the cold water, and the fishes are fond of it. As a food, physicians condemn the too free use of cheese. When new, it is extremely difficult of digestion: when old, it becomes acrid and hot; and, from Dr Percival's experiments, is evidently of a septic nature. It is a common opinion that old cheese digests every thing, yet is left undigested itself; but this is without any solid foundation. Cheese made from the milk of sheep digests sooner than that from the milk of cows, but is less nourishing; that from the milk of goats digests sooner than either, but is also the least nourishing. In general, it is a kind of food fit only for the laborious, or those whose organs of digestion are strong.

Every country has places noted for this commodity: thus Chester and Gloucester cheese are famous in England; and the Parmesan cheese is in no less repute abroad, especially in France. This sort of cheese is entirely made of sweet cow-milk: but at Rochefort in Languedoc, they make it of ewes milk; and in other places it is usual to add goat or ewes milk in a certain proportion to that of the cow. There is likewise a kind

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Cheese described.

* See Chemistry.

^{Management of the Dairy.} kind of medicated cheese made by intimately mixing the expressed juice of certain herbs, as sage, baum, mint, &c. with the curd before it is fashioned into a cheese. The Laplanders make a sort of cheese of the milk of their rein-deer; which is not only of great service to them as food, but on many other occasions. It is a very common thing in these climates to have a limb numbed and frozen with the cold: their remedy for this is the heating an iron red hot, and thrusting it through the middle of one of these cheeses; they catch what drops out, and with this anoint the limb, which soon recovers. They are subject also to coughs and diseases of the lungs, and these they cure by the same sort of medicine: they boil a large quantity of the cheese in the fresh deer's milk, and drink the decoction in large draughts warm several times a-day. They make a less strong decoction of the same kind also, which they use as their common drink, for three or four days together, at several times of the year. They do this to prevent the mischiefs they are liable to from their water, which is otherwise their constant drink, and is not good.

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Making of
cheese.

In making cheese the same precaution is to be observed as with regard to butter, viz. the milk ought not to be agitated by carrying to any distance; nor ought the cows to be violently driven before they are milked, which reduces the milk almost to the same state as if agitated in a barrel or churn. To this cause Mr Twamley, who has written a treatise upon dairy management, attributes the great difficulty sometimes met with in making the milk coagulate; four or five hours being sometimes necessary instead of one (the usual time employed); and even after all, the curd will be of such a soft nature, that the cheese will swell, puff up, and rent in innumerable places, without ever coming to that solid consistence which it ought to have. As this frequently happens in consequence of heat, Mr Twamley advises to mix a little cold spring water with the milk. It is a bad practice to put in more runnet when the curd appears difficult to be formed; for this, after having once formed the curd by the use of a certain quantity, will dissolve it again by the addition of more.

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General de-
fects of
cheese.

The most common defects of cheese are its appearing when cut full of small holes called *eyes*; its puffing up, cracking, and pouring out quantities of thin serous liquor; becoming afterwards rotten and full of maggots in those places from which the liquor issued. All this, according to our author, proceeds from the formation of a substance called by him *slip curd*, a kind of half coagulum, incapable of a thorough union with the true curd, and which when broken into very small bits produces *eyes*; but if in larger pieces, occasions those rents and cracks in the cheese already mentioned; for though this kind of curd retains its coagulated nature for some time, it always sooner or latter dissolves into a serous liquid. This kind of curd may be produced, 1. By using the milk too hot. 2. By bad runnet. 3. By not allowing the curd a proper time to form. The first of these is remedied by the use of cold water, which our author says is so far from being detrimental to the quality of the cheese, that it really promotes the action of the runnet upon the milk. The second, viz. a knowledge of good from bad runnet, can only be acquired by long practice, and no particular direc-

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tions can be given, farther than that the utmost care must be taken that it have no putrid tendency, nor any rancidity from too great heat in drying. The only rule that can be given for its preparation is to take out the maw of a calf which has fed entirely upon milk; and if it is cold, swill it a little in water; rub it well with salt; then fill it with the same, and afterwards cover it. Some cut them open and spread them in salt, putting them in layers above one another, letting them continue in the brine they produce, sometimes stirring or turning them for four, six, or nine months; after which they are opened to dry, stretched out upon sticks or splints. They may be used immediately after being dried, though it is reckoned best to keep them till they be a year old before they are used. The best method of making the runnet from the skins, according to our author, is the following: "Take pure spring water, in quantity proportioned to the runnet you intend to make; it is thought best by some two skins to a gallon of water; boil the water, which makes it softer or more pure: make it with salt into brine that will swim an egg: then let it stand till the heat is gone off to about the heat of blood-warm; then put your maw-skin in, either cut in pieces or whole; the former I should imagine best or most convenient; letting it steep 24 hours, after which it will be fit for use. Such quantity as is judged necessary must then be put into the milk; about a tea-cupful being necessary for ten cows milk; though in this respect very particular directions cannot be given."

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In the Bath Papers Mr Hazard gives the following receipt for making runnet: "When the maw-skin is well prepared and fit for the purpose, three pints of soft water, clean and sweet, should be mixed with salt, wherein should be put sweet brier, rose leaves and flowers, cinnamon, cloves, mace, and in short almost every sort of spice and aromatic that can be procured; and if these are put into two quarts of water, they must boil gently till the liquor is reduced to three pints, and care should be taken that this liquid is not smoked; it should be strained clear from the spices, &c. and when found not to be warmer than milk from the cow; it should be poured upon the vell or maw; a lemon may then be sliced into it, when it may remain a day or two; after which it should be strained again and put into a bottle, where, if well corked, it will keep good for twelve months or more; it will smell like a perfume, and a small quantity of it will turn the milk, and give the cheese a pleasing flavour." He adds, that if the vell or maw be salted and dried for a week or two near the fire, it will do for the purpose again almost as well as before.

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In the making of cheese, supposing the runnet to be of a good quality, the following particulars must be observed: 1. The proper degree of heat. This ought to be what is called *milk-warm*, or, "a few degrees removed from coolness," according to Mr Twamley; considerably below the heat of milk taken from the cow. If too hot, it may be reduced to a proper temperature by cold water, as already mentioned. 2. The time allowed for the runnet to take effect. This, our author observes ought never to be less than an hour and a half. The process may be accelerated, particularly by putting salt to the milk before

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Of prepara-
tion of run-
net.

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Mr Hazard's re-
ceipt for making
runnet.

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Particulars to be ob-
served in the making of
cheese.

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fore the runnet is added. Mr Twamley advises two handfuls to ten or twelve cows milk; but he assures us, that no bad consequence can follow from the curd being formed ever so soon: as it then only becomes more solid and fit for making cheese of a proper quality. 3. To prevent any difficulty in separating the curd from the whey, prepare a long cheese-knife from lath; one edge being sharpened to cut the curd across from top to bottom in the tub, crossing it with lines checkerwise: by which means the whey rises through the vacancies made by the knife, and the curd sinks with much more ease. A sieve has been used with success, in order to separate the whey perfectly from the curd. 4. Having got the curd all firm at the bottom of the tub, take the whey from it; let it stand a quarter of an hour to drain before you put it into the vat to break it. If any bits of slip curd swim among the whey, pour it all off together rather than put it among the cheese, for the reasons already given. Some dairy-women allow the curd to stand for two hours; by which time it is become of so firm a nature that no breaking is necessary: they have only to cut it in slices, put it into the vat, and work it well by squeezing thoroughly to make it sit close; then put it into the press. Our author, however, approves more of the method of breaking the curd, as less apt to make the cheese hard and horny. 5. When the whey is of a white colour, it is a certain sign that the curd has not subsided; but if the method just now laid down be followed, the whey will always be of a green colour; indeed this colour of the whey is always a certain criterion of the curd having been properly managed. 6. The best method of preventing cheese from heaving, is to avoid making the runnet too strong; to take care that it be clean, and not tainted; to be certain that the curd is fully come, and not to stir it before the air has had time to escape; a quantity of air being always discharged in this as in many other chemical processes. 7. Cheese is very apt to split in consequence of being "salted within," especially when the vat is about half filled. In this case the curd, though separated only in a small degree by the salt, never closes or joins as it ought to do. Mr Twamley prefers salting in the milk greatly to this method. 8. Dry cracks in cheese are generally produced by keeping curd from one meal to another, and letting the first become too stiff and hard before it is mixed with the other. 9. Curdly or wrinkle-coated cheese is caused by sour milk. Cheese made of cold milk is apt to be hard, or to break and fly before the knife. 10. Such coated cheese is caused by being made too cold, as cheese that is made in winter or late in autumn is apt to be, unless laid in a warm room after it is made.

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Different
kinds of
cheese.

Cheese is of very different quality, according to the milk from which it is made: Thus, in Gloucestershire, what is called the *second* or *two-meal* cheese, is made from one meal of new milk and one of skimmed or old milk, having the cream taken away. Skimmed cheese, or *flet-milk* cheese, is made entirely from skimmed milk, the cream having been taken off to make butter. It goes by the name of *Suffolk cheese*, and is much used at sea; being less liable to be affected by the heat of warm climates than the other kinds. A great deal of difference, however, is to be observed in the quali-

ty of it, which our author supposes to arise chiefly from greater care being taken in some places than in others.

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Slip-coat or soft cheese is made entirely of slip-curd, and dissolves into a kind of creamy liquor; which is a demonstration of the nature of this curd, as already mentioned. It is commonly computed, that as much milk is required to make one pound of butter as two of cheese; and even more where the land is poor, and the pastures afford but little cream.

Best methods of making cheese in England. The double Gloucester is a cheese that pleases almost every palate. The best of this kind is made from new, or (as it is called in that and the adjoining counties) *coward milk*. An inferior sort is made from what is called *half-coward milk*; though when any of these cheeses turn out to be good, people are deceived, and often purchase them for the best *coward milk cheese*: but farmers who are honest have them stamped with a piece of wood made in the shape of a heart, so that any person may know them.

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Double
Gloucester.

It will be every farmer's interest (if he has a sufficient number of cows) to make a large cheese from one meal's milk. This, when brought in warm, will be easily changed or turned with the runnet; but if the morning or night's milk be to be mixed with that which is fresh from the cow, it will be a longer time before it turns, nor will it change sometimes without being heated over the fire, by which it often gets dust or soot, or smoke, which will give the cheese a very disagreeable flavour.

When the milk is turned, the whey should be carefully strained from the curd. The curd should be broken small with the hands; and when it is equally broken, it must be put by a little at a time into the vat, carefully breaking it as it is put in. The vat should be filled an inch or more above the brim, that when the whey is pressed out, it may not shrink below the brim; if it does, the cheese will be worth very little. But first, before the curd is put in, a cheese-cloth, or strainer, should be laid at the bottom of the vat: and this should be so large, that when the vat is filled with the curd, the ends of the cloth may turn again over the top of it. When this is done, it should be taken to the press, and there remain for the space of two hours, when it should be turned and have a clean cloth put under it and turned over as before. It must then be pressed again, and remain in the press six or eight hours; when it should again be turned and rubbed on each side with salt. After this it must be pressed again for the space of 12 or 14 hours more; when, if any of the edges project, they should be pared off: it may then be put on a dry board, where it should be regularly turned every day. It is a good way to have three or four holes bored round the lower part of the vat, that the whey may drain so perfectly from the cheese as not the least particle of it may remain.

The prevailing opinion of the people of Gloucestershire and the neighbouring counties is, that the cheeses will spoil if they do not scrape and wash them when they are found to be mouldy. But others think that suffering the mould to remain mellows them, provided they are turned every day. Those, however, who will have the mould off, should cause it to be removed with a clean dry flannel, as the washing the cheeses

Management of the Dairy. is only a means of making the mould (which is a species of fungus rooted in the coat) grow again immediately.

Some people scald the curd: but this is a bad and mercenary practice; it robs the cheese of its fatness, and can only be done with a view to raise a greater quantity of whey butter, or to bring the cheeses forward for sale, by making them appear older than they really are.

As most people like to purchase high coloured cheese, it may be right to mix a little annatto with the milk before it is turned. No cheese will look yellow without it; and though it does not in the least add to the goodness, it is perfectly innocent in its nature and effects.

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Cheddar
cheese.

Cheddar cheese is held in high esteem; but its goodness is said to be chiefly owing to the land whereon the cows feed, as the method of making is the same as is pursued throughout Somersetshire and the adjoining counties.

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Cheshire
cheese.

Cheshire cheese is much admired; yet no people take less pains with the runnet than the Cheshire farmers. But their cheeses are so large as often to exceed one hundred pounds weight each; to this (and the age they are kept, the richness of the land, and the keeping such a number of cows as to make such a cheese, without adding a second meal's milk) their excellence may be attributed. Indeed they salt the curd (which may make a difference), and keep the cheeses in a damp place after they are made, and are very careful to turn them daily.

The following account of the mode of making this cheese is stated in the Annals of Agriculture, by Mr John Chamberlaine of Chester. "The process of making Cheshire cheese is as follows, viz. on a farm capable of keeping 25 cows, a cheese of about sixty pounds weight may be daily made, in the months of May, June, and July.

"The evening's milk is kept untouched until next morning, when the cream is taken off, and put to warm in a brass pan heated with boiling water; then one third part of that milk is heated in the same manner, so as to bring it to the heat of new milk from the cow; (this part of the business is done by a person who does not assist in milking the cows during that time.) Let the cows be milked early in the morning; then the morning's new milk, and the night's milk, thus prepared, are put into a large tub together with the cream; then a portion of runnet that has been put into water milk-warm the evening before is put into the tub, sufficient to coagulate the milk; and at the same time, if annatto be used to colour the cheese, a small quantity, as requisite for colouring, (or a marigold or carrot infusion) is rubbed very fine, and mixed with the milk, by stirring all together; then covering it up warm, it is to stand about half an hour, or until coagulated; at which time it is first turned over with a bowl, to separate the whey from the curds, and broken soon after with the hand and bowl into very small particles; the whey being separated by standing some time, is taken from the curd, which sinks to the bottom; the curd is then collected into a part of the tub which has a slip or loose board across the diameter of the bottom of it, for the sole use of separating them; and a board is placed thereon, with weights, from sixty to

a hundred and twenty pounds, to press out the whey: when it is getting into a more solid consistence, it is cut, and turned over in slices several times, to extract all the whey, and then weighted as before; which operations may take up about an hour and a half. It is then taken from the tub, as near the side as possible, and broken very small by hand, and salted, and put into a cheese vat, enlarged in depth by a tin hoop to hold the quantity, it being more than bulk when finally put into the press. Then press the side well by hand, and with a board at top well weighted; and placing wooden skewers round the cheese to the centre, and drawing them out frequently, the upper part of the cheese will be drained of its whey: then shift it out of the vat; first put a cloth upon the top of it, and reverse it by the cloth into another vat, or the same, which vat should be well scalded before the cheese is returned into it; then the top part is broken by hand down to the middle, and salt mixed with it, and skewered as before, then pressed by hand, weighted, and all the whey extracted. This done, reverse the cheese again into another vat, warmed as before, with a cloth under it; then a tin hoop or binder is put round the upper edge of the cheese and within the sides of the vat, the cheese being first inclosed in a cloth, and the edges of it put within the vat.

"N.B. The cloth is of fine hemp, one yard and a half long by one yard wide. It is so laid, that on one side of the vat it shall be level with the side of it, on the other it shall lap over the whole of the cheese, and the edges put within the vat; and the tin fillet to go over the whole. All the above operations will take from seven in the morning till one at noon. Finally, it is put into a press of fifteen or twenty cwt. and stuck round the vat into the cheese with thin wire skewers, which are shifted occasionally. In four hours more it should be shifted and turned, and in four hours more, the same, and the skewering continued. Next morning, let it be turned by the woman who attends the milk, and put under another or the same press, and so turned at night and the next morning; at noon taken out finally to the salting room, there salt the outside, and put a cloth binder round it. The cheese should, after such salting, be turned twice a-day for six or seven days, then left two or three weeks to dry, turned and cleaned every day, taken to the common cheese room, laid on straw on a boarded floor, and daily turned until grown hard.

"The room should be moderately warm; but no wind or draught of air should be permitted, which generally cracks them. Some rub the outsides with butter or oil to give them a coat.

"The spring-made cheese is often shipped for the London market in the following autumn, and it is supposed to be much ameliorated by the heating on board the vessel."

But of all the cheese this kingdom produces, none is more highly esteemed than the Stilton, which is called the *Parmesan* of England, and (except faulty) is never sold for less than 1s. or 1s. 2d. per pound.

The Stilton cheeses are usually made in square vats, and weigh from six to twelve pounds each cheese. Immediately after they are made, it is necessary to put them into square boxes made exactly to fit them; they being so extremely rich, that except this precaution

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be taken they are apt to bulge out, and break asunder. They should be continually and daily turned in these boxes, and must be kept two years before they are properly mellowed for sale.

Some make them in a net somewhat like a cabbage net; so that they appear, when made, not unlike an acorn. But these are never so good as the other, having a thicker coat, and wanting all that rich flavour, and mellowness which make them so pleasing.

It is proper to mention that the making of these cheeses is not confined to the Stilton farmers, as many others in Huntingdonshire (not forgetting Rutland and Northamptonshire) make a similar sort, sell them for the same price, and give all of them the name of *Stilton cheeses*.

Though these farmers are remarked for cleanliness, they take very little pains with the runnet, as they in general only cut pieces from the vell or maw, which they put into the milk, and move gently about with the hand, by which means it breaks or turns it so, that they easily obtain the curd. But if the method above described for making runnet were put in practice, they would make their cheese still better; at least they would not have so many faulty and unsound cheeses; for notwithstanding their cheeses bear such a name and price, they often find them so bad as not to be saleable; which is probably owing to their being so careless about the runnet.

It has been alleged, that as good cheese might be made in other counties, if people would adhere to the Stilton plan, which is this: They make a cheese every morning; and to this meal of new milk they add the cream taken from that which was milked the night before. This, and the age of their cheeses, have been supposed the only reasons why they are preferred to others; for, from the nicest observation, it does not appear that their land is in any respect superior to that of other counties.

Excellent cream cheeses are made in Lincolnshire, by adding the cream of one meal's milk to milk which comes immediately from the cow; these are pressed gently two or three times, turned for a few days, and are then disposed of at the rate of 1s. per pound, to be eaten while new with radishes, salad, &c.

Many people give skimmed milk to pigs; but the whey will do equally well after cheeses are made from this milk: such cheeses will always sell for at least 2d. per pound, which will amount to a large sum annually where they make much butter. The peasants and many of the farmers in the north of England never eat any better cheese; and though they appear harder, experience hath proved them to be much easier of digestion than any new milk cheeses. A good market may always be found for the sale of them at Bristol.

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Parmesan
cheese.

Account of the making of Parmesan cheese; by Mr Zappa of Milan: in answer to queries from Arthur Young, Esq.

"Are the cows regularly fed in stables?"—From the middle of April, or sooner, if possible, the cows are sent to pasture in the meadows till the end of November usually.

"Or only fed in stables in winter?"—When the season is past, and snow comes, they are put into stables for the whole winter, and fed with hay.

"Do they remain in the pasture from morning till night, or only in hot weather?"—Between nine and ten in the morning the cows are sent to water, and then to the pastures, where they remain four or five hours at most, and at three or four o'clock are driven to the stables if the season is fresh, or under porticoes if hot; where, for the night, a convenient quantity of hay is given them.

"In what months are they kept at pasture the whole day?"—Mostly answered already; but it might be said, that no owner will leave his cattle, without great cause, in uncovered places at night. It happens only to the shepherds from the Alps, when they pass, because it is impossible to find stables for all their cattle.

"What is the opinion in the Lodesan, on the best conduct for profit in the management of meadows?"—For a dairy farm of 100 cows, which yields daily a cheese weighing 70 or 75lb. of 28 ounces, are wanted 1000 perticas of land. Of these about 800 are standing meadows, the other 200 are in cultivation for corn and grass fields in rotation.

"Do they milk the cows morning and evening?"—Those that are in milk are milked morning and evening, with exception of such as are near calving.

"One hundred cows being wanted to make a Lodesan each day, it is supposed that it is made with the milk of the evening and the following morning; or of the morning and evening of the same day: how is it?"—The 100 cows form a dairy farm of a good large cheese; it is reckoned that 80 are in milk, and 20 with calves sucking, or near calving. They reckon one with the other about 32 boccalis of 32 oz. of milk. Such is the quantity for a cheese of about 70lb. of 28 ounces. They join the evening with the morning milk, because it is fresher than if it was that of the morning and evening of the same day. The morning milk would be 24 hours old when the next morning the cheese should be made.

"Do they skim or not the milk to make butter before they make the cheese?"—From the evening milk all the cream possible is taken away for butter, mascarpone (cream cheese), &c. The milk of the morning ought to be skimmed slightly. But every one skims as much cream as he can. The butter is sold on the spot immediately at 24 sous: the cheese at about 28 sous. The butter loses nothing in weight: the cheese loses one third of it, is subject to heat, and requires expences of service, attention, warehouses, &c. before it is sold; and a man in two hours makes 45 or 50lb. of butter that is sold directly. However, it is not possible to leave much cream in the milk to make Lodesan cheese, called *grained cheese*; because, if it is too rich, it does not last long, and it is necessary to consume it while young and sound.

"Is Parmesan or Lodesan cheese made every day in the year or not?"—With 100 cows it is. In winter, however, the milk being less in quantity, the cheese is of lesser weight, but certainly more delicate.

"After gathering or uniting the milk, either skimmed or not, what is exactly the whole operation?"—The morning of the 3d of March 1786, I have seen the whole operation, having gone on purpose to the spot to see the whole work from beginning to end. At 16 Italian hours, or ten in the morning, according to the

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Management of the Dairy. the northern way to account hours, the skimming of that morning's milk, gathered only two hours before, was finished. I did, meanwhile, examine the boiler or pot. At the top it was eight feet (English) diameter, or thereabout, and about five feet three inches deep; made like a bell, and narrowing towards the bottom to about two and one-half feet. They joined the cream produced that morning with the other produced by the milk of the evening before. That produced by this last milk was double in quantity to that of the morning milk, because it had the whole night to unite, and that of the morning had only two hours to do it: in which it could not separate much. Of the cream, some was destined to make mascarpone (cream cheese), and they put the rest into the machine for making butter. Out of the milk of the evening before and of that morning, that was all put together after skimming, they took and put into the boiler 272 boccali, and they put under it two faggots of wood; which being burnt, were sufficient to give the milk a warmth a little superior to lukewarm. Then the boiler being withdrawn from the fire, the foreman put into it the runnet, which they prepare in small balls of one ounce each, turning the ball in his hand always kept in the milk entirely covered; and after it was perfectly dissolved, he covered the boiler to keep the milk defended, that it might not suffer from the coldness of the season, particularly as it was a windy day. I went then to look on the man that was making mascarpone, &c. and then we went twice to examine if the milk was sufficiently coagulated. At the 18 hours, according to the Italian clocks, or noon, the true manufactory of cheese began. The milk was coagulated in a manner to be taken from the boiler in pieces from the surface. The foreman, with a stick that had 18 points, or rather nine small pieces of wood fixed by their middle in the end of it, and forming nine points on each side, began to break exactly all the coagulated milk, and did continue to do so for more than half an hour, from time to time examining it to see its state. He ordered to renew the fire, and four faggots of willow branches were used all at once: he turned the boiler that the fire might act; and then the underman began to work in the milk with a stick, like the above, but only with four smaller sticks at the top, forming eight points, four at each side, a span long each point. In a quarter of an hour the foreman mixed in the boiler the proper quantity of saffron, and the milk was all in knobs and finer grained than before, by the effect of turning and breaking the coagulation, or curd, continually. Every moment the fire was renewed or fed; but with a faggot only at a time, to continue it regular. The milk was never heated much, nor does it hinder to keep the hand in it to know the fineness of the grain, which refines continually by the stick-work of the underman. It is of the greatest consequence to mind when the grain begins to take a consistence. When it comes to this state, the boiler is turned from the fire, and the underman immediately takes out the whey, putting it into proper receivers. In that manner the grain subsides to the bottom of the boiler; and leaving only in it whey enough to keep the grain covered a little, the foreman extending himself as much as he can over and in the boiler, unites with his hands the grained milk, making like a

body of paste of it. Then a large piece of linen is run by him under that paste, while another man keeps the four corners of it, and the whey is directly put again into the boiler, by which is facilitated the means of raising that paste that is taken out of the boiler, and put for one quarter of an hour into the receiver where the whey was put before, in the same linen it was taken from the boiler; which boiler is turned again directly on the fire, to extract the mascarpa (whey cheese); and is a second product, eaten by poor people. After the paste remained for a quarter of an hour in that receiver, it was taken out and turned into the wooden form called *sassera*, without any thing else made than the rotundity, having neither top nor bottom. Immediately after having returned it into that round wooden form, they put a piece of wood like a cheese on it, putting and increasing gradually weights on it, which serve to force out the remnant of the whey; and in the evening the cheese so formed is carried into the warehouse, where, after 24 hours, they begin to give the salt. It remains in that warehouse for 15 or 20 days; but in summer only from 8 to 12 days. Meanwhile the air and salt form the crust to it; and then it is carried into another warehouse for a different service. In the second warehouse they turn every day all the cheeses that are not older than six months; and afterwards it is enough if they are only turned every 48 or 60 hours, keeping them clean, in particular, of that bloom which is inevitable to them, and which, if neglected, turns musty, and causes the cheese to acquire a bad smell. The Lodesean, because it is a province watered, has a great deal of meadows, and abounds with cows, its product being mostly in cheese, butter, &c. However, the province of Pavia makes a great deal of that cheese; and we Milanese do likewise the same from the side of Porte Tosa, Romana, Ticinese, and Vercilino, because we have fine meadows and dairy farms.

Making of Fruit-Liquors.

SECT. IX. Making of Fruit-Liquors.

THESE, as objects of British husbandry, are principally two, *Cyder* and *Perry*; the manufacturing of which forms a capital branch in our fruit-counties, and of which the improvement must be considered as of great importance to the public, but particularly so to the inhabitants of those districts where these liquors constitute their common beverage.

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Fruit-Liquors.

Cyder and perry, when genuine and in high perfection, are excellent vinous liquors, and are certainly far more wholesome than many others which at present are in much higher estimation. When the must is prepared from the choicest fruit, and undergoes the exact degree of vinous fermentation requisite to its perfection, the acid and the sweet are so admirably blended with the aqueous, oily, and spirituous principles, and the whole so imbued with the grateful flavour of the rinds, and the agreeable aromatic bitter of the kernels, that it assumes a new character; grows lively, sparkling, and exhilarating; and when completely mellowed by time, the liquor becomes at once highly delicious to the palate, and congenial to the constitution; superior in every respect to most other English wines, and perhaps not inferior to many of the best foreign wines. Such (says Dr Fothergill) would

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Excellence of cyder and perry.

* Bath Pers. vol. v. p. 343.

Making of Fruit-Liquors. would it be pronounced by all competent judges, were it not for the popular prejudice annexed to it as a cheap home-brewed liquor, and consequently within the reach of the vulgar. To compare such a liquor with the foreign fiery sophisticated mixtures often imported under the name of wines, would be to degrade it; for it certainly surpasses them in flavour and pleasantness, as much as it excels them in wholesomeness and cheapness. But rarely do we meet with perry or cyder of this superior quality. For what is generally sold by dealers and inkeepers is a poor, meagre, vapid liquor, prone to the acetous fermentation, and of course very injurious to the constitution. Is it not very mortifying, after the experience of so many centuries, that the art of preparing these ancient British liquors, should still be so imperfectly understood as to seem to be in its very infancy?—That throughout the principal cyder districts, the practice should still rest on the most vague indeterminate principles, and that the excellence of the liquor should depend rather on a lucky random hit, than on good management? Yet such appears to be really the case even among the most experienced cyder-makers of Herefordshire and Gloucestershire.

605 Art of making them not yet perfectly understood. Mr Marshall, that nice observer of rural affairs, in his tour* through those counties (expressly undertaken for the purpose of inquiry on this subject), informs us, that scarcely two of these professional artists are agreed as to the management of some of the most essential parts of the process: That palpable errors are committed as to the time and manner of gathering the fruit—in laying it up—in neglecting to separate the unsound—and to grind properly the rinds and kernels, &c.: That the method of conducting the vinous fermentation, the most critical part of the operation, and which stamps the future value of the liquor, is by no means ascertained; while some promote the fermentation in a spacious open vat, others repress it by inclosing the liquor in a hogshead, or strive to prevent it altogether: That no determinate point of temperature is regarded, and that the use of the thermometer is unknown or neglected: That they are as little consistent as to the time of racking off; and whether this ought to be done only once, or five or six times repeated: That for fining down the liquor many have recourse to that odious article, bullocks blood, when the intention might be much better answered by whites of eggs or isinglass. And, finally, that the capricious taste of particular customers is generally consulted, rather than the real excellence of the liquor; and consequently that a very imperfect liquor is often vended, which tends to reduce the price, to disgrace the vender, and to bring the use of cyder and perry into disrepute.

The art of making vinous liquors is a curious chemical process; and its success chiefly depends on a dexterous management of the vinous fermentation, besides a close attention to sundry minute circumstances, the theory of which is perhaps not yet fully understood by the ablest chemists. Can we longer wonder then that so many errors should be committed by illiterate cyder-makers, totally unversed in the first principles of the chemical art? Some few, indeed, more enlightened than their brethren, and less bigotted to their own opinions, by dint of observation strike out improve-

ments, and produce every now and then a liquor of superior quality, though perhaps far short of excellence, yet still sufficient to show what might possibly be accomplished by a series of new experiments conducted on philosophical principles. This might lead to successive improvements, till at length our English fruit-liquors might be carried to a pitch of perfection hitherto unknown, by which the demand, both at home and abroad, would soon be enlarged, the prices augmented according to the quality, the value of estates increased, and the health and prosperity of these counties proportionably advanced. This might also help to point out a method of correcting the imperfections of these liquors; and of meliorating those of a weak meagre quality, by safer and more effectual means than are now practised: and though nothing can fully compensate the defect of sunshine in maturing the saccharine juices in unfavourable seasons, yet probably such liquors might, without the dangerous and expensive method of boiling in a copper vessel, admit of considerable improvement by the addition of barm or other suitable ferment, as yet unknown in the practice of the cyder districts; or perhaps rather by a portion of rich must, or some wholesome sweet, as honey, sugar-candy, or even molasses, added in due proportion, previous to the fermentation. In fact, it appears from a late publication †, that the Germans are known to meliorate their thin harsh wines by an addition of concentrated must, not by evaporation, but by freezing. By this simple process they are made to emulate good French wines: a practice worthy of imitation, especially in the northern climates.

Cyder, as is well known, is made from apples and perry from pears only. The general method of preparing both these liquors is very much the same; and under the article CYDER a description will be given of the way in which those fruits are gathered, ground, and pressed. The mill is not essentially different from that of a common tanner's mill for grinding bark. It consists of a mill-stone from two and a half to four feet and a half in diameter, running on its edge in a circular stone trough, from nine to twelve inches in thickness, and from one to two tons in weight. The bottom of the trough in which this stone runs is somewhat wider than the thickness of the stone itself; the inner side of the groove rises perpendicularly, but the outer spreads in such a manner as to make the top of the trough six or eight inches wider than the bottom; by which means there is room for the stone to run freely, and likewise for putting in the fruit, and stirring it up while grinding. The bed of a middle-sized mill is about 9 feet, some 10, and some 12; the whole being composed of two, three, or four stones cramped together and finished after being cramped in this manner. The best stones are found in the forest of Dean; generally a dark reddish gritstone, not calcareous; for if it were of a calcareous quality, the acid juice of the fruits would act upon it and spoil the liquor: a clean-grained grindstone grit is the fittest for the purpose. The runner is moved by means of an axle passing through the centre, with a long arm reaching without the bed of the mill, for a horse to draw by; on the other side is a shorter arm passing through the centre of the stone, as represented

* Rural Econ. of Gloucestershire, ii. p. 303.
606 Errors pointed out.

607 Means of improvement.

† Hopson's Chemistry.

608 Description of a cyder mill and mill-house.

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sented in the figure. An iron bolt, with a large head, passes through an eye, in the lower part of the swivel on which the stone turns, into the end of the inner arm of the axis; and thus the double motion of it is obtained, and the stone kept perfectly upright. There ought also to be fixed on the inner arm of the axis, about a foot from the runner, a cogged wheel working in a circle of cogs, fixed upon the bed of the mill. The use of these is to prevent the runner from sliding, which it is apt to do when the mill is full; it likewise makes the work more easy for the horse. These wheels ought to be made with great exactness. Mr Marshall observes, that it is an error to make the horse draw by traces: "The acting point of draught (says he), the horse's shoulder, ought, for various reasons, to be applied immediately at the end of the arm of the axis; not two or three yards before it; perhaps of a small mill near one fourth of its circumference." The building in which the mill is inclosed ought to be of such a size, that the horse may have a path of three feet wide betwixt the mill and the walls; so that a middling-sized mill, with its horse-path, takes up a space of 14 or 15 feet every way. The whole dimensions of the mill-house, according to our author, to render it any way convenient, are 24 feet by 20: it ought to have a floor thrown over it at the height of seven feet; with a door in the middle of the front, and a window opposite, with the mill on one side and the press on the other side of the window. The latter must be as near the mill as convenience will allow, for the more easy conveying the ground fruit from the one to the other. The press, which is of a very simple construction, has its bed or bottom about five feet square. This ought to be made entirely either of wood or stone; the practice of covering it with lead being now universally known to be pernicious. It has a channel cut within a few inches of its outer edge, to catch the liquor as it is expressed, and convey it to a lip formed by a projection on that side of the bed opposite to the mill; having under it a stone trough, or wooden vessel, sunk within the ground, when the bed is fixed low, to receive it. The press is worked with levers of different lengths; first a short, and then a moderately long one, both worked by hand; and lastly, a bar eight or nine feet long worked by a capstan or windlass. The expence of fitting up a mill-house is not very great. Mr Marshall computes it from 20l. to 25l. and on a small scale, from 10l. to 15l. though much depends on the distance and carriage of the stone: when once fitted up, it will last many years.

The making of the fruit-liquors under consideration requires an attention to the following particulars.—

I. The fruit. II. The grinding. III. Pressing. IV. The fermenting. V. Correcting. VI. Laying up. VII. Bottling:—each of which heads is subdivided into several others.

I. In the management of the fruit the following particulars are to be considered.

1. The time of gathering, which varies according to the nature of the fruit. The early pears are fit for the mill in September; but few apples are ready for gathering before Michaelmas; though, by reason of accidental circumstances, they are frequently manu-

factured before that time. For sale cyder, and keeping drink, they are suffered to hang upon the trees till fully ripe; and the middle of October is generally looked upon to be a proper time for gathering the store-apple. The criterion of a due degree of ripeness is the fruit falling from the tree: and to force it away before that time, in Mr Marshall's opinion, is robbing it of some of its most valuable particles. "The harvesting of fruits (says he) is widely different in this respect from the harvesting of grain; which has the entire plant to feed it after its separation from the soil; while fruit, after it is severed from the tree, is cut off from all possibility of a further supply of nourishment; and although it may have reached its wonted size, some of its more essential particles are undoubtedly left behind in the tree. Sometimes, however, the fruits which are late in ripening are apt to hang on the tree until spoiled by frosts; though weak watery fruits seem to be most injured in this manner; and Mr Marshall relates an instance of very fine liquor being made from golden pippins, after the fruit had been frozen as hard as ice.

2. The method of gathering. This, as generally practised, is directly contrary to the principle laid down by Mr Marshall, viz. beating them down with long slender poles. An evident disadvantage of this method is, that the fruit is of unequal ripeness; for the apples on the same trees will differ many days, perhaps even weeks, in their time of coming to perfection; whence some part of the richness and flavour of the fruit will be effectually and irremediably cut off. Nor is this the only evil to be dreaded; for as every thing depends on the fermentation it has to undergo, if this be interrupted, or rendered complex by a mixture of ripe and unripe fruits, and the liquor be not in the first instance sufficiently purged from its feculencies, it is difficult to clear the liquor afterwards. The former defect the cyder-makers attempt to remedy by a mixture of brown sugar and brandy, and the latter by bullocks blood and brimstone; but neither of these can be expected to answer the purpose very effectually. The best method of avoiding the inconveniences arising from an unequal ripening of the fruit is to go over the trees twice, once with a hook, when the fruit begins to fall spontaneously; the second time, when the latter are sufficiently ripened, or when the winter is likely to set in, when the trees are to be cleared with the poles above mentioned.

3. Maturing the gathered fruit. This is usually done by making it into heaps, as is mentioned under the article CYDER; but Mr Marshall entirely disapproves of the practice; because, when the whole are laid in a heap together, the ripest fruit will begin to rot before the other has arrived at that degree of artificial ripeness which it is capable of acquiring. "The due degree of maturation of fruit for liquor (he observes) is a subject about which men, even in this district, differ much in their ideas. The prevailing practice of gathering into heaps until the ripest begins to rot, is wasting the best of the fruit, and is by no means an accurate criterion. Some shake the fruit, and judge by the rattling of the kernels; others cut through the middle, and judge by their blackness; but none of these appear to be a proper test. It is not the state of the kernels but of the flesh; not of a few individuals, but of the greater part of the prime fruits, which render the collective body.

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dy fit or unfit to be sent to the mill. The most rational test of the ripeness of the fruit, is that of the flesh having acquired such a degree of mellowness, and its texture such a degree of tenderness, as to yield to moderate pressure. Thus, when the knuckle or the end of the thumb can with moderate exertion be forced into the pulp of the fruit, it is deemed in a fit state for grinding."

4. Preparation for the mill. The proper management of the fruit is to keep the ripe and unripe fruit separate from each other: but this cannot be done without a considerable degree of labour; for as by numberless accidents the ripe and unripe fruits are frequently confounded together, there cannot be any effectual method of separating them except by hand; and Mr Marshall is of opinion, that this is one of the grand secrets of cyder-making, peculiar to those who excel in the business; and he is surprised that it should not before this time have come into common practice.

5. Mixing fruits for liquor. Our author seems to doubt the propriety of this practice; and informs us, that the finer liquors are made from select fruits; and he hints that it might be more proper to mix liquors after they are made, than to put together the crude fruits.

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Grinding.

II. *Grinding*, and management of the fruit when ground.

1. For the greater convenience of putting the fruit into the mill, every mill-house should have a fruit-chamber over it, with a trap-door to lower the fruit down into the mill. The best manner in which this can be accomplished, is to have the valve over the bed of the mill, and furnished with a cloth spout or tunnel reaching down to the trough in which the stone moves. No straw is used in the lofts; but sometimes the fruit is turned. In Herefordshire, it is generally believed, that grinding the rind and seeds of the fruit as well as the fleshy part to a pulp, is necessary towards the perfection of the cyder; whence it is necessary, that every kind of pains should be taken to perform the grinding in the most perfect manner. Mr Marshall complains, that the cyder-mills are so imperfectly finished by the workmen, that for the first *fifty years* they cannot perform their work in a proper manner. Instead of being nicely fitted to one another with the square and chisel, they are hewn over with a rough tool in such a careless manner, that horse-beans might lie in safety in their cavities. Some even imagine this to be an advantage, as if the fruit was more effectually and completely broken by rough than smooth stones. Some use fluted rollers of iron; but these will be corroded by the juice, and thus the liquor might be tinged. Smooth rollers will not lay hold of the fruit sufficiently to force it through.

Another improvement requisite in the cyder-mills is to prevent the matter in the trough from rising before the stone in the last stage of grinding, and a method of stirring it up in the trough more effectually than can be done at present. To remedy the former of these defects, it might perhaps be proper to grind the fruit first in the mill to a certain degree; and then put it between two smooth rollers to finish the operation in the most perfect manner. It is an error to grind too much at once: as this clogs up the mill, and prevents it from going easily. The usual quantity for a middle-

sized mill is a bag containing four corn bushels; but our author had once an opportunity of seeing a mill in which only half a bag was put; and thus the work seemed to go on more easily as well as more quickly than when more was put in at once. The quantity put in at one time is to be taken out when ground. The usual quantity of fruit ground in a day is as much as will make three hogsheads of perry or two of cyder.

2. Management of the ground fruit. Here Mr Marshall condemns in very strong terms the practice of pressing the pulp of the fruit as soon as the grinding is finished; because thus neither the rind nor seeds have time to communicate their virtues to the liquor. In order to extract these virtues in the most proper manner, some allow the ground fruit to lie 24 hours or more after grinding, and even regrind it, in order to have in the most perfect manner the flavour and virtues of the seeds and rind.

III. *Pressing the fruit*, and management of the *residuum*. This is done by folding up the ground fruit in pieces of hair-cloth, and piling them up above one another in a square frame or mould, and then pulling down the press upon them, which squeezes out the juice, and forms the matter into thin and almost dry cakes. The first runnings come off foul and muddy; but the last, especially in perry, will be as clear and fine as if filtered through paper. It is common to throw away the residuum as useless: sometimes it is made use of when dry as fuel; sometimes the pigs will eat it, especially when not thoroughly squeezed; and sometimes it is ground a second time with water, and squeezed for an inferior kind of liquor used for the family. Mr Marshall advises to continue the pressure as long as a drop can be drawn. "It is found (says he), that even by breaking the cakes of refuse with the hands only gives the press fresh power over it; for though it has been pressed to the last drop, a gallon or more of additional liquor may be got by this means. Regrinding them has a still greater effect: In this state of the materials the mill gains a degree of power over the more rigid parts of the fruits, which in the first grinding it could not reach. If the face of the runner and the bottom of the trough were dressed with a broad chisel, and made true to each other, and a moderate quantity of residuum ground at once, scarcely a kernel could escape unbroken, or a drop of liquor remain undrawn."

But though the whole virtue of the fruit cannot be extracted without grinding it very fine, some inconvenience attends this practice, as part of the pulp thus gets through the haircloth, and may perhaps be injurious to the subsequent fermentation. This, however, may be in a great measure remedied by straining the first runnings through a sieve. The whole should also be allowed to settle in a cask, and drawn off into a fresh vessel previous to the commencement of the fermentation. The reduced fruit ought to remain some time between the grinding and pressing, that the liquor may have an opportunity of forming an extract with the rind and kernels: but this must not be pushed too far, as in that case the colour of the cyder would be hurt: and the most judicious managers object to the pulp remaining longer than 12 hours without pressure. "Hence (says our author), upon the whole, the most eligible

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&c.

Making of Fruit-Liquors. eligible management in this stage of the art appears to be this: Grind one pressful a day; press and regrind the residuum in the evening; infuse the reduced matter all night among part of the first runnings; and in the morning repress while the next pressful is grinding.

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Fermentation.

IV. *Fermentation.* The common practice is to have the liquor tunned; that is, put into casks or hogsheads immediately from the press, and to fill them quite full: but it is undoubtedly more proper to leave some space empty to be filled up afterwards. No accurate experiment has been made with regard to the temperature of the air proper to be kept up in the place where the fermentation goes on. Frost is prejudicial: but when the process usually commences, that is, about the middle of October, the liquor is put into airy shades, where the warmth is scarce greater than in the open atmosphere; nay, the casks are frequently exposed to the open air without any covering farther than a piece of tile or flat stone over the bunghole, propped up by a wooden pin on one side to cause the rain water to run off. In a complete manufactory of fruit-liquor, the fermenting room should be under the same roof with the mill-house; a continuation of the press-room, or at least opening into it, with windows or doors on every side, to give a free admission of air into it; sufficient defences against frost; fruit-lofts over it, and vaults underneath for laying up the liquors after fermentation; with small holes in the crown of the arch to admit a leathern pipe, for the purpose of conveying the liquors occasionally from the one to the other.

In making of fruit-liquors, no ferment is used as in making of beer; though, from Mr Marshall's account of the matter, it seems far from being unnecessary. Owing to this omission, the time of the commencement of the fermentation is entirely uncertain. It takes place sometimes in one, two, or three days; sometimes not till a week or month after tunning; but it has been observed, that liquor which has been agitated in a carriage, though taken immediately from the press, will sometimes pass almost immediately into a state of fermentation. The continuance of the fermentation is no less uncertain than the commencement of it. Liquors when much agitated, will go through it perhaps in one day; but when allowed to remain at rest, the fermentation commonly goes on two or three days, and sometimes five or six. The fermenting liquor, however, puts on a different appearance according to circumstances. When produced from fruits improperly managed, it generally throws up a thick scum resembling that of malt liquor, and of a thickness proportioned to the species and ripeness of the fruit; the riper the fruit, the more scum being thrown up. Perry gives but little scum, and cyder will sometimes also do the same; sometimes it is intentionally prevented from doing it.

After having remained some time in the fermenting vessel, the liquor is racked or drawn off from the lees and put into fresh casks. In this part of the operation also Mr Marshall complains greatly of the little attention that is paid to the liquor. The ordinary time for racking perry is before it has done hissing, or sometimes when it begins to emit fixed air in plenty. The only intention of the operation is to free the li-

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quor from its fæces by a cock placed at a little distance from the bottom; after which the remainder is to be filtered through a canvas or flannel bag. This filtered liquor differs from the rest in having a higher colour; having no longer any tendency to ferment, but on the contrary checking the fermentation of that which is racked off; and if it loses its brightness, it is no longer easily recovered.—A fresh fermentation usually commences after racking; and if it become violent, a fresh racking is necessary in order to check it; in consequence of which the same liquor will perhaps be racked five or six times: but if only a small degree of fermentation takes place, which is called *fretting*, it is allowed to remain in the same cask; though even here the degree of fermentation which requires racking is by no means determined. Mr Marshall informs us that the best manufacturers, however, repeat the rackings until the liquor will lie quiet, or nearly so; and if it be found impracticable to accompany this by the ordinary method of fermentation, recourse must be had to fumigation with sulphur, which is called *stunning* the casks. For this fumigation it is necessary to have matches made of thick linen cloth about ten inches long, and an inch broad, thickly coated with brimstone for about eight inches of their length. The cask is then properly seasoned, and every vent except the bunghole tightly stopped; a match is kindled, lowered down into the cask, and held by the end undipped until it be well lighted, and the bung be driven in: thus suspending the lighted match within the cask. Having burnt as long as the contained air will supply the fire, the match dies, the bung is raised, the remnant of the match drawn out, and the cask suffered to remain before the liquor be put into it for two or three hours, more or less according to the degree of power the sulphur ought to have. The liquor retains a smell of the sulphureous acid; but this goes off in a short time, and no bad effect is ever observed to follow.

In some places the liquor is left to ferment in open casks, where it stands till the first fermentation be pretty well over; after which the frost or yeast collected upon the surface is taken off, it being supposed that it is this yeast mixing with the clear liquor which causes it to fret after racking. The fermentation being totally ceased, and the lees subsided, the liquor is racked off into a fresh cask, and the lees filtered as above directed. The author mentions a way of fermenting fruit-liquors in broad shallow vats, not less than five feet in diameter, and little more than two feet deep; each vat containing about two hogsheads. In these the liquor remains until it has done rising, or till the fermentation has nearly ceased, when it is racked off without skimming, the critical juncture being caught before the yeast fall; the whole sinking gradually together as the liquor is drawn off. In this practice also the liquor is seldom drawn off a second time.

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Cyder is made of three different kinds, viz. *rough*, Different *sweet*, and *of a middle richness*. The first kind being kinds of usually destined for servants, is made with very little cyder ceremony. "If it is but *zeyder* (says Mr Marshall), and has body enough to keep, no matter for the richness and flavour. The rougher it is, the further it will go, and the more acceptable custom has rendered it not only to the workmen but to their masters. A palate accustomed to rough cyder would judge the rough

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rough cyder of the farm-houses to be a mixture of vinegar and water, with a little dissolved alum to give it roughness." The method of producing this austere liquor is to grind the fruit in a crude under-ripe state, and subject the liquor to a full fermentation.—For the sweet liquor, make choice of the sweet fruits; mature them fully; and check the fermentation of the liquor.—To produce liquors of a middle richness, the nature of the fruit, as well as the season in which it is matured, must be considered. The fruits to be made choice of are such as yield juices capable of affording a sufficiency both of richness and strength; though much depends upon proper management. Open vats, in our author's opinion, are preferable to close vessels: but if casks be used at all, they ought to be very large, and not filled; nor ought they to lie upon their sides, but to be set on their ends with their heads out, and to be filled only to such a height as will produce the requisite degree of fermentation: but in whatever way the liquor be put to ferment, Mr Marshall is of opinion that the operation ought to be allowed to go on freely for the first time; though after being racked off, any second fermentation ought to be prevented as much as possible.

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V. *Correcting*, provincially called *doctoring*. The imperfections which art attempts to supply in these liquors are, 1. Want of strength; 2. Want of richness; 3. Want of flavour; 4. Want of colour and brightness.

The want of strength is supplied by brandy or any other spirit in sufficient quantity to prevent the acetous fermentation. The want of richness is supplied by what are generally termed *sweets*, but prepared in a manner which our author says has never fallen under his notice. To supply the want of flavour an infusion of hops is sometimes added, which is said to communicate an agreeable bitter, and at the same time a fragrance; whence it becomes a substitute for the juices of the rind and kernels thrown away to the pigs and poultry, or otherwise wasted. The want of colour is sometimes supplied by elder berries, but more generally by burnt sugar, which gives the desired colour, and a degree of bitter which is very much liked. The sugar is prepared either by burning it on a salamander, and suffering it to drop, as it melts, into water; or by boiling it over the fire (in which case brown sugar is to be used), until it acquire an agreeable bitter; then pouring in boiling water in the proportion of a gallon to two pounds of sugar, and stir until the liquor become uniform. A pint of this preparation will colour a hogshead of cyder. Brightness is obtained by a mixture of the blood of bullocks and sheep; that of swine being rejected, though it does not appear to be more unfit for the purpose than either of the other two. The only thing necessary to be done here is to stir the blood well as it is drawn from the animal, to prevent the parts from separating; and it ought to be stirred "both ways for a quarter of an hour." The liquor, however, is not always in a proper condition for being refined with this ingredient: on which account a little of it ought frequently to be tried in a vial. A quart or less will be sufficient for a hogshead. After the blood is poured in, the liquor should be violently agitated, to mix the whole intimately together. This is done by a stick slit into four, and inserted into the

bunghole; working it briskly about in the liquor until the whole be thoroughly mixed. In about 24 hours the blood will be subsided, and the liquor ought instantly to be racked off; as by remaining upon the blood even for two or three days, it will receive a taint not easily to be got rid of. It is remarkable, that this refinement with the blood carries down not only the fæces, but the colour also; rendering the liquor, though ever so highly coloured before, almost as limpid as water. Isinglass and eggs are sometimes made use of in fining cyder as well as wine.

VI. The *laying up* or shutting up the cyder in close casks, according to Mr Marshall, is as little understood as any of the rest of the parts; the bungs being commonly put in at some certain time, or in some particular month, without any regard to the state the liquor itself is in. "The only criterion (says he) I have met with for judging the critical time of laying up, is when a fine white cream-like matter first begins to form upon the surface. But this may be too late; it is probably a symptom at least of the acetous fermentation, which if it takes place in any degree must be injurious. Yet if the casks be bunged tight, some criterion is necessary; otherwise, if the vinous fermentation have not yet finally ceased, or should recommence, the casks will be endangered, and the liquor injured. Hence, in the practice of the most cautious manager whose practice I have had an opportunity of observing, the bungs are first driven in lightly, when the liquor is fine, and the vinous fermentation is judged to be over; and some time afterward, when all danger is past, to fill up the casks, and drive the bungs securely with a rag, and rosin them over at top. Most farmers are of opinion, that after the liquor is done fermenting, it ought to have something to *feed upon*; that is, to prevent it from running into the acetous fermentation. For this purpose some put in parched beans, others egg-shells, some mutton suet, &c. Mr Marshall does not doubt that something may be useful; and thinks that isinglass may be as proper as any thing that can be got.

VII. *Bottling*. This depends greatly on the quality of the liquors themselves. Good cyder can seldom be bottled with propriety under a year old: sometimes not till two. The proper time is when it has acquired the utmost degree of richness and flavour in the casks; and this it will preserve for many years in bottles. It ought to be quite fine at the time of bottling; or if not so naturally, ought to be fined artificially with isinglass and eggs.

The liquor, called *cyderkin*, *purre*, or *perkin*, is made of the murk or gross matter remaining after the cyderkin is pressed out. To make this liquor, the murk is put into a large vat, with a proper quantity of boiled water, which has stood till it be cold again: if half the quantity of water be used that there was of cyder, it will be good; if the quantities be equal, the cyderkin will be small. The whole is left to infuse 48 hours, and then well pressed; what is squeezed out by the press is immediately tunned up and stopped; it is fit to drink in a few days. It clarifies of itself, and serves in families instead of small beer. It will keep, if boiled, after pressure, with a convenient quantity of hops.

We must not conclude this section without particular

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cular notice of the liquor called *cyder wine*, which is made from the juice of apples taken from the press and *boiled*, and which being kept three or four years is said to resemble Rhenish. The method of preparing this wine, as communicated by Dr Rush of America, where it is much practised, consists in evaporating in a brewing copper the fresh apple-juice till half of it be consumed. The remainder is then immediately conveyed into a wooden cooler, and afterwards is put into a proper cask, with an addition of yeast, and fermented in the ordinary way. The process is evidently borrowed from what has long been practised on the recent juice of the grape, under the term of *vin cuit*, or boiled wine, not only in Italy, but also in the islands of the Archipelago, from time immemorial.

This process has lately become an object of imitation in the cyder counties, and particularly in the west of England, where it is reported that many hundred hogs-heads of this wine have already been made: and as it is said to betray no sign of an impregnation of copper by the usual chemical tests, it is considered as perfectly wholesome, and is accordingly drunk without apprehension by the common people. Others, however, suspect its innocence; whence it appeared an object of no small moment to determine in so doubtful a matter, whether or not the liquor acquires any noxious quality from the copper in which it is boiled. With this view Dr Fothergill* made a variety of experiments; and the result seemed to afford a strong presumption that the cyder wine *does* contain a minute impregnation of copper; not very considerable indeed, but yet sufficient, in the doctor's opinion, to put the public on their guard concerning a liquor that comes in so very "questionable a shape."

It is a curious chemical fact, he observes, if it be really true, that acid liquors, while kept boiling in copper vessels, acquire little or no impregnation from the metal, but presently begin to act upon it when left to stand in the cold. Can this be owing to the agitation occasioned by boiling, or the expulsion of the aerial acid? Atmospheric air powerfully corrodes copper, probably through the intervention of the aerial or rather nitrous acid, for both are now acknowledged to be present in the atmosphere. But the latter is doubtless a much stronger menstruum of copper than the former.

In the present process the liquor is properly directed to be passed into a wooden cooler as soon as the boiling is completed. But as all acids, and even common water, acquire an impregnation and unpleasant taste, from standing in copper vessels in the cold, why may not the acid juice of apples act in some degree on the copper before the boiling commences? Add to this, that brewing coppers, without far more care and attention than is generally bestowed on them in keeping them clean, are extremely apt to contract verdigrise, (a rank poison), as appears from the blue or green streaks very visible when these vessels are minutely examined. Should the unfermented juice be thought incapable of acting on the copper either in a cold or boiling state, yet no one will venture to deny its power of washing off or dissolving verdigrise already formed on the internal surface of the vessel. Suppose only one-eighth part of a grain of verdigrise to be

contained in a bottle of this wine, a quantity that may elude the ordinary tests, and that a bottle should be drunk daily by a person without producing any violent symptoms or internal uneasiness; yet what person in his senses would knowingly choose to hazard the experiment of determining how long he could continue even this quantity of a slow poison in his daily beverage with impunity? And yet it is to be feared the experiment is but too often unthinkingly made, not only with cyder wine, but also with many of the foreign wines prepared by a similar process. For the grape juice, when evaporated in a copper vessel, under the denomination of *vin coto* or boiled wine, cannot but acquire an equal, if not yet stronger impregnation of the metal, than the juice of apples, seeing that verdigrise itself is manufactured merely by the application of the acid husks of grapes to plates of copper.

Independent of the danger of any metallic impregnation, the doctor thinks, it may be justly questioned how far the process of preparing boiled wines is necessary or reconcileable to reason or economy. The evaporation of them must by long boiling not only occasion an unnecessary waste of both liquor and fuel, but also dissipates certain essential principles, without which the liquor can never undergo a complete fermentation; and without a complete fermentation there can be no perfect wine. Hence the boiled wines are generally crude, heavy, and flat, liable to produce indigestion, flatulency, and diarrhoea. If the evaporation be performed hastily, the liquor contracts a burnt empyreumatic taste, as in the present instance; if slowly, the greater is the danger of a metallic impregnation. For the process may be presumed to be generally performed in a vessel of brass or copper, as few families possess any other that is sufficiently capacious. Nor can a vessel of cast-iron, though perfectly safe, be properly recommended for this purpose, as it would probably communicate a chalybeate taste and dark colour to the liquor. At all events, brass and copper vessels ought to be entirely banished from this and every other culinary process.

SECT. X. Of Fences.

WE shall conclude the present subject of agriculture by taking notice of the various kinds of fences that may be found valuable in it.—Robert Somerville, Esq. of Haddington, in a communication to the Board of Agriculture, has endeavoured to enumerate the whole simple and compound fences that are at present used. *Simple fences* are those that consist of one kind only, as a ditch, a hedge, or a wall.—*Compound fences* are made by the union of two or more of these, as a hedge and ditch, or hedge and wall. The following is the list which he has given of them:

"Simple Fences.

- I. Simple ditch, with a bank on one side.
- II. Double ditch, with a bank of earth between.
- III. Bank of earth, with a perpendicular facing of sod.
- IV. Ha-ha, or sunk fence.
- V. Palings, or *timber fences*, of different kinds, viz.
 1. Simple nailed paling of rough timber.
 2. Jointed horizontal paling.
 3. Upright lath paling.

3 T 2

4. Horizontal

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Kinds of
fences enu-
merated.

* Bath Pa-
pers, vol. v.
p. 330.

Fences.

4. Horizontal paling of young firs.
5. Upright ditto of do.
6. Chain fence.
7. Net fence.
8. Rope fence.
9. Flake or hurdle fence.
10. Osier or willow fence.
11. Fence of growing posts.
12. Shingle fence, horizontal.
13. Ditto, upright.
14. Warped paling.
15. Open paling, warped with dead thorns or branches of trees.

VI. Dead hedges, various kinds.

VII. Live hedges.

VIII. Walls.

1. Dry stone wall, coped and uncoped.
2. Stone and lime ditto, do.
3. Stone and clay, do.
4. Stone and clay, harled, or dashed with lime.
5. Dry stone, ditto, lipped with lime.
6. Dry stone, ditto, lipped and harled.
7. Dry stone, pined and harled.
8. Brick walls.
9. Frame walls.
10. Galloway dike or wall.
11. Turf wall.
12. Turf and stone in alternate layers.
13. Mud walls, with straw.

"Compound Fences."

1. Hedge and ditch, with or without paling.
2. Double ditto.
3. Hedge and bank, with or without paling.
4. Hedge in the face of a bank.
5. Hedge on the top of a bank.
6. Devonshire fence.
7. Hedge, with single or double paling.
8. Hedge and dead hedge.
9. Hedge and wall.
10. Hedge, ditch, and wall.
11. Hedge in the middle of a wall.
12. Hedge and ditch, with rows of trees.
13. Hedge, or hedge and wall, with belt of planting.
14. Hedge with the corners planted.
15. Reed fence, or port and rail, covered with reeds."

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Ditches.

Of the nature of each of these, and the advantages attending the use of them, we shall take some short notice. The ditch, which is one of the simple fences, is most frequently considered merely as an open drain intended to relieve the soil of superfluous moisture. It is frequently, also, however, made use of without any such intention, as a fence for the confinement of cattle; but it is more frequently used with the double view of serving as a fence, and as a drain. It is made in a variety of ways, according to the object in view. If a ditch is meant to be used merely as a drain, the earth thrown out of it ought by no means to be formed into a bank upon the side of it, because such a practice, as formerly stated, when treating of draining, has a tendency to injure its utility by cutting off its communication with one side of the field to be drained; but when a ditch is intended to be used as a fence, a different rule of proceeding must be followed. In that

case, the object in view will be greatly forwarded by forming the earth taken out of the ditch into a bank upon its side, and when added to the depth of the ditch, will form a barrier of considerable value.

Fences.

Ditches are sometimes formed of an uniform breadth at top and bottom. This kind of ditch is liable to many objections. After frosts and rains, its sides are perpetually crumbling down and falling in, and if the field in which such a ditch is placed have a considerable declivity, the bottom of the ditch will be extremely liable to be undermined by any current of water, that either permanently or casually takes place in it; at the same time, such ditches have been found very useful in low-lying clay or carse soils where the country is level. From the nature of the soil, the sides of the ditches in such situations are tolerably durable. No rapid current of water can exist to undermine them; and, by their figure, they withdraw from the plough the smallest possible portion of surface.

Other ditches are constructed wide above, with a gradual slope from both sides downwards. This form of a ditch is in general the best, where it is at all to be used for the drainage of the field, as the sides are not so liable as in the former case to be excavated by the current of water. Hence it is more durable, and by diminishing the quantity of digging at the bottom, it is more easily executed.

A third kind of ditches are so formed as to have one side sloping, and the other perpendicular. This kind of ditch partakes of the whole perfections and imperfections of the two former. It is extremely useful, however, in fields of which sheep form a part of the stock, and where the bottom of the ditch contains a current of water; for, in such cases, when sheep tumble into a deep ditch, whose sides are pretty steep, they are very apt to perish; but by making one side of the ditch very much sloped, while the other approaches to the perpendicular, they are enabled to make their escape; while at the same time by the bed of the stream being widened, the perpendicular side of the ditch is less liable to be undermined. When the earth taken out of a ditch is formed into a bank on one side, a projecting vacant space of six or eight inches ought always to be left between the bank and the ditch, to prevent the earth from tumbling in and filling up the ditch.

A double ditch, with a bank of earth between the two, formed out of the earth obtained by digging them, has many obvious advantages over the single ditch, when considered as a fence; for the earth taken out of the two ditches, when properly laid up in the middle, will naturally become a very formidable rampart, which cattle will not readily attempt to cross. It is also excellently adapted for the purpose of open drainage, and it ought always to be used upon the sides of highways, where the adjoining lands have a considerable declivity towards the road. In such cases the inner ditch receives the water from the field, and prevents it from washing down or overflowing the road in the time of heavy rains: an inconvenience which frequently cannot otherwise be avoided.

The bank of earth, with a perpendicular facing of sod, and a slope behind, is useful in some situations, as earth, in making folds for the confinement of sheep or cattle, in which case the front or perpendicular side of the bank

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Fences.

Fences.

bank must be turned inwards. It is also valuable on the sides of highways to protect the adjoining fields, and also for fencing belts of planting, or inclosing stack-yards and cottages. The front of the bank is made with the turfs taken from the surface of the sloping ditch, and the mound at the back with the earth taken out of it. This fence, when well executed, is said to last a considerable time.

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The ha-ha,
or sunk
fence.

The ha-ha, or sunk fence, very nearly resembles the mound of earth with the perpendicular facing of turf, with this difference, that the facing of the ha-ha is of stone. The height of both depends almost entirely upon the depth of the ditch; both of them in truth consist of the kind of ditch already mentioned, of which the one side slopes while the other is perpendicular, and differ from it chiefly in this respect, that the perpendicular side is faced with turf or stone. The stone-facing is made either of dry stone, or of stone and lime. In the Agricultural Report of Cromarty, the mode of making the sunk fence is thus described: "Upon the line where this fence is intended, begin to sink your ditch, taking the earth from as far as eight feet outward, and throwing it up on the inside of the lines. This ditch and bank is not made quite perpendicular, but inclining inward towards the field as it rises; to this is built a facing of dry stone, four feet and a half in height, one foot and three quarters broad at bottom, and one foot at top, over which a coping of turf is laid: the ditch or sunk part forms an excellent drain. The whole of this is performed, when the stones (we shall suppose) can be procured at a quarter of a mile's distance, for 6d. per yard." The principal defect of the sunk fence consists in this, that unless the bank at the back of it is considerably steep, or has a railing at the top, it forms a kind of snare on that side for cattle, as they must always be apt to tumble over it in dark nights.

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lings.

Paling, or timber fences, are in many places much used, though they can never be considered with propriety as forming permanent inclosures. Of whatever materials they are formed, their decay commences from the instant they are erected. Their decay begins with the part of the paling that is put into the ground, which is speedily rotted by the moisture, or consumed by worms or other animals that attack it. To guard as much as possible against this cause of decay, various devices have been adopted. It is a very general practice to burn the surface of that part of the standards of the paling which is meant to be driven into the earth. It is also customary to cover the same part of the wood with a strong coat of coarse oil paint, and Lord Dundonald's coal varnish has been recommended with this view. The points of the standards that are to be fixed in the earth, ought to be dipped in the varnish while it is boiling hot. Common tar or melted pitch have also been used with tolerable success to defend the extremities of the standards of paling. In some cases where the expence could be afforded, large stones have been sunk into the earth, with holes cut into them of a size adapted to receive the ends of the posts of the paling. The durability of the wood in this case is greater, but it bears no proportion to the additional expence incurred. When posts for paling can be obtained consisting of branches of trees, with the bark still upon them, this natural covering enables

them to remain uncorrupted for a longer period than can be accomplished by any artificial coating. It is no objection to this, that a part of the uncovered wood, or the bottom of the stake or post, must be inserted in the earth; for it is not at the bottom that stakes or posts begin to decay, but at the uppermost place at which the earth touches them, or between the wet and the dry as it is called. Of the kinds of paling it is unnecessary to say much.

The simple nailed paling of rough timber, consists of posts or stakes inserted in the earth, and crossed with three, four, or more horizontal bars or slabs as they are called in Scotland. It is the most common of all, and is used to protect young hedges, or to strengthen ditches when used as fences.

The jointed horizontal paling, consists of massy square poles drove into the earth, and having openings cut into them for the reception of the extremities of the horizontal bars. These openings, however, weaken the poles much, and cause them soon to decay; but this kind of paling has a very handsome and substantial appearance.

The upright lath paling, is formed by driving strong piles of wood into the earth, and crossing these at top and bottom, with horizontal pieces of similar strength. Upon these last are nailed, at every 6 or 12 inches distance, laths or pieces of sawn wood, of the shape and size of the laths used for the roofs of tiled houses. This kind of paling prevents cattle from putting their heads through to crop or injure young hedges or trees.

The horizontal paling of firs, or the weedings of other young trees, does not differ from the palings already described, unless in this respect, that the materials of which it is formed, consist not of timber cut down for the purpose, but of the thinnings of woods or belts of planting. Such palings are usually more formidable to cattle than any other, because when the lateral twigs that grow out of large branches are loped off in a coarse manner, the branch still retains a roughness which keeps cattle at a distance.

The chain horizontal fence is made by fixing strong piles of wood in the earth in the direction in which the fence is to run, and fixing three chains at regular distances, extending horizontally from pile to pile, instead of cross bars of wood. Instead of posts of wood, pillars of mason work are sometimes used, and between these the chains are extended. A chain fence will confine horses or cattle, but is unfit to confine sheep or hogs. From its expensive nature, it can only be used in public walks, or for stretching across streams or pieces of water, where the inclosure can be completed in no other way.

The net fence is used for pleasure grounds, and instead of chains, as in the former case, it consists of a strong net extended between upright piles. Such a fence may be a very pretty ornament, but could be of little use against the horns of cattle.

The rope fence is constructed like the chain fence, and differs from it only in the use of cords instead of metal chains, and has the same defect of being useless against swine and sheep.

The moveable wooden fence or flake, or hurdle fence, consists of a kind of moveable paling, used for confining sheep or cattle to a certain spot when feeding upon a turnip field, and in this view it is extremely useful;

^{Fences.} useful; for if the cattle were allowed to range at large over the field, a great quantity of the turnips would be destroyed by having pieces eaten from them, which would immediately spoil and rot before the remainder could be consumed; whereas, by the use of these moveable palings, the sheep or cattle having only a certain quantity of food allotted to them at a time, are compelled to eat it clean up without any loss.

The osier or willow fence, or wattled fence, is made by driving in the direction of the fence, stakes of willow or poplar, of half the thickness of a man's wrist, into the earth, about 18 inches asunder. They are then bound together with small twigs of the willows or poplars twisted and interwoven with them. If the upright stakes have been recently cut down, and if the fence is made about the end of autumn, they will take root and grow in the spring. If their new lateral branches are afterwards properly interwoven and twisted together, they will become in two or three years a permanent and almost impenetrable fence.

The paling of growing trees, or rails nailed to growing posts, is formed by planting beech, larch, or other trees, at the distance of a yard from each other, in the direction in which the fence is wanted. When 10 or 12 feet high, they must be cut down to six feet. The cutting of the tops will make them push out a great number of lateral branches, which may be interwoven with the upright part of the tree, as in the case of the willow fence already mentioned.

The horizontal and upright shingle fence is formed in this manner; stout piles are driven into the earth, and deals, of from half an inch to an inch thick, are nailed horizontally upon them in such a way, that the under edge of the uppermost deal projects over the upper edge of the one immediately below it, like slates or tiles upon houses. In like manner, the shingles or boards may be placed perpendicularly and bound together, by being nailed to horizontal bars of wood.

The warped paling consists of pieces of wood driven into the earth, which are twisted and interwoven with each other, so as to form a very open net-work; the tops of the pieces of wood being bound together by willows or other twigs.

The light open fence with thorns, or branches of trees wove into it, is nothing more than a common paling, whose interstices are filled up with thorns or branches of trees. It is a very effectual fence while it lasts.

Dead hedges are made of the prunings of trees, or the tops of live hedges that have been cut down. They are sometimes made upon the top of the mound of earth taken out of a ditch, by inserting the thick ends of the twigs in the earth, and making them rest in an oblique manner. Sometimes the stronger pieces or stakes are fixed in the earth, and the smaller twigs are used to fasten them together at top, by a kind of net-work. What is called the stake and rice fence in Scotland, consists of a dead hedge or fence, formed of upright posts, the intervals between which are filled up with twigs woven horizontally. All these, however, can only be regarded as fences of a very temporary nature, which are constantly in want of repairs, and therefore requiring a continual expence.

Before planting live hedges, it is proper to consider the nature of the land, and what sorts of plants will

thrive best in it; and also, what is the soil from whence the plants are to be taken. As for the size, the sets ought to be about the thickness of one's little finger, and cut within about four or five inches of the ground; they ought to be fresh taken up, straight, smooth, and well-rooted. Those plants that are raised in the nursery are to be preferred.

In planting outside hedges, the turf is to be laid, with the grass-side downwards, on that side of the ditch on which the bank is designed to be made; and some of the best mould should be laid upon it to bed the quick, which is to be set upon it a foot asunder. When the first row of quick is set, it must be covered with mould; and when the bank is a foot high, you may lay another row of sets against the spaces of the former, and cover them as you did the others: the bank is then to be topped with the bottom of the ditch, and a dry or dead hedge laid, to shade and defend the under plantation. Stakes should then be driven into the loose earth, so low as to reach the firm ground: these are to be placed at about two feet and a half distance: and in order to render the hedge yet stronger, you may edder it, that is, bind the top of the stakes with small long poles; and when the eddering is finished, drive the stakes anew.

The quick must be kept constantly weeded, and secured from being cropped by cattle; and in February it will be proper to cut it within an inch of the ground, which will cause it strike root afresh, and help it much in the growth.

The crab is frequently planted for hedges; and if the plants are raised from the kernels of the small wild crab. crabs, they are much to be preferred to those raised from the kernels of all sorts of apples without distinction; because the plants of the true small crab never shoot so strong as those of the apples, and may therefore be better kept within the proper compass of a hedge.

The black thorn, or sloe, is frequently planted for hedges; and the best method of doing it is to raise the plants from the stones of the fruit, which should be sown about the middle of January, if the weather will permit, in the place where the hedge is intended; but when they are kept longer out of the ground, it will be proper to mix them with sand, and keep them in a cool place. The same fence will do for it when sown, as when it is planted.

The holly is sometimes planted for hedges; but where it is exposed, there will be great difficulty in preventing its being destroyed: otherwise, it is by far the most beautiful plant; and, being an evergreen, will afford much better shelter for cattle in winter than any other sort of hedge. The best method of raising these hedges, is to sow the stones in the place where the hedge is intended; and, where this can be conveniently done, the plants will make a much better progress than those that are transplanted; but these berries should be buried in the ground several months before they are sown. The way to do this, is to gather the berries about Christmas, when they are usually ripe, and put them into large flower-pots, mixing some sand with them; then dig holes in the ground, into which the pots must be sunk, covering them over with earth, about ten inches thick. In this place they must remain till the following October, when they should be taken

Fences.

Fences.

taken up, and sown in the place where the hedge is intended to be made. The ground should be well trenched and cleared from the roots of all bad weeds, bushes, trees, &c. Then two drills should be made, at about a foot distance from each other, and about two inches deep, into which the seed should be scattered pretty close, lest some should fail. When the plants grow up, they must be carefully weeded: and if they are designed to be kept very neat, they should be cut twice a-year, that is in May and in August; but if they are only designed for fences, they need only be sheered in July. The fences for these hedges, while young, should admit as much free air as possible; the best sort are these made with posts and rails, or with ropes drawn through holes made in the posts; and if the ropes are painted over with a composition of melted pitch, brown Spanish colour and oil, well mixed, they will last several years.

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Of garden
hedges.

Hedges for ornament in gardens are sometimes planted with evergreens, in which case the holly is preferable to any other; next to this, most people prefer the yew; but the dead colour of its leaves renders those hedges less agreeable. The laurel is one of the most beautiful evergreens; but the shoots are so luxuriant that it is difficult to keep it in any tolerable shape; and as the leaves are large, to prevent the disagreeable appearance given them by their being cut through with the sheers, it will be the best way to prune them with a knife, cutting the shoots just down to a leaf. The laurustinus is a very fine plant for this purpose; but the same objection may be made to this as to the laurel: this, therefore, ought only to be pruned with a knife in April when the flowers are going off; but the new shoots of the same spring must by no means be shortened. The small-leaved and rough leaved laurustinus are the best plants for this purpose. The true Phillyrea is the next best plant for hedges, which may be led up to the height of 10 or 12 feet; and if they are kept narrow at the top, that there may not be too much width for the snow to lodge upon them, they will be close and thick, and make a fine appearance. The ilex, or evergreen oak, is also planted for hedges, and is a fit plant for those designed to grow very tall.—The deciduous plants usually planted to form hedges in gardens are, the hornbeam, which may be kept neat with less trouble than most other plants. The beech, which has the same good qualities with the hornbeam; but the gradual falling of its leaves in winter causes a continual litter. The small-leaved English elm is a proper tree for tall hedges, but these should not be planted closer than eight or ten feet. The lime-tree has also been recommended for the same purpose; but after they have stood some years, they grow very thin at bottom, and their leaves frequently turn of a black disagreeable colour.

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Of flower-
ing shrubs.

Many of the flowering shrubs have also been planted in hedges, such as roses, honey-suckles, sweet briar, &c. but these are difficult to train; and if they were cut to bring them within compass, their flowers, which are their greatest beauty, will be entirely destroyed. A correspondent of the society for improving agriculture in Scotland, however, informs us, that he tried with success the eglantine, sweet briar, or dog rose, when all the methods of making hedges practised in Essex

and Hampshire had been tried in vain. His method was to gather the hips of this plant, and to lay them in a tub till March; the seeds were then easily rubbed out; after which they were sowed in a piece of ground prepared for garden pease. Next year they came up; and the year after they were planted in the following manner. After marking out the ditch, the plants were laid about 18 inches asunder upon the side grass, and their roots covered with the first turfs that were taken off from the surface of the intended ditch. The earth side of these turfs was placed next to the roots, and other earth laid upon the turfs which had been taken out of the ditch. In four or five years these plants made a fence which neither horses nor cattle of any kind could pass. Even in two or three years none of the larger cattle will attempt a fence of this kind. Sheep indeed will sometimes do so, but they are always entangled to such a degree, that they would remain there till they died unless relieved. Old briars dug up and planted soon make an excellent fence; and, where thin, it may be easily thickened by laying down branches, which in one year will make shoots of six or seven feet. They bear clipping very well.

Dr Anderson, who hath treated the subject of hedg-
ing very particularly, is of opinion, that some other son's direc-
plants besides those above mentioned might be usefully tions.

employed in the construction of hedges. Among these he reckons the common willow. This, he says, by no means requires the wetness of soil which is commonly supposed. "It is generally imagined (says he), that the willow can be made to thrive nowhere except in wet or boggy ground: but this is one of those vulgar errors, founded upon inaccurate observation, too often to be met with in subjects relating to rural affairs; for experience has sufficiently convinced me, that this plant will not only grow, but thrive, in any rich well cultivated soil (unless in particular circumstances that need not here be mentioned) even although it be of a very dry nature. It could not, however, in general be made to thrive, if planted in the same manner as thorns; nor would it, in any respect, be proper to train it up for a fence in the same way as that plant. The willow, as a fence, could seldom be successfully employed, but for dividing into separate inclosures any extensive field of rich ground: and, as it is always necessary to put the soil into as good order as possible before a hedge of this kind is planted in it, the easiest method of putting it into the necessary high tilth, will be to mark off the boundaries of your several fields in the winter, or early in the spring, with a design to give a complete fallow to a narrow ridge, six or eight feet broad, in the middle of which the hedge is intended to be planted the ensuing winter. This ridge ought to be frequently ploughed during the summer season, and in the autumn to be well manured with dung or lime, or both (for it cannot be made too rich), and be neatly formed into a ridge before winter.

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Dr Anderson's on
Agriculture, i. 54:
&c.

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Of the wil-
low.

"Having prepared the ground in this manner, it will be in readiness to receive the hedge, which ought to be planted as early in winter as can be got conveniently done; as the willow is much hurt by being planted late in the spring. But before you begin to make a fence of this kind, it will be necessary to provide a sufficient number of plants: which will be best done.

Fences.

done by previously rearing them in a nursery of your own, as near the field to be inclosed as you can conveniently have it; for as they are very bulky, the carriage of them would be troublesome if they were brought from any considerable distance. The best kinds of willow for this use, are such as make the longest and strongest shoots, and are not of a brittle nature. All the large kinds of hoop-willows may be employed for this use; but there is another kind with stronger and more taper shoots, covered with a dark green bark when young, which, upon the older shoots, becomes of an ash grey, of a firm texture, and a little rough to the touch. The leaves are not so long, and a great deal broader than those of the common hoop-willow, pretty thick and of a dark-green colour. What name this species is usually known by, I cannot tell; but as it becomes very quickly of a large size at the root, and is strong and firm, it ought to be made choice of for this purpose in preference to all other kinds that I have seen. The shoots ought to be of two or three years growth before they can be properly used, and should never be less than eight or nine feet in length. These ought to be cut over close by the ground immediately before planting, and carried to the field at their whole length. The planter having stretched a line along the middle of the ridge which was prepared for their reception, begins at one end thereof, thrusting a row of these plants firmly into the ground, close by the side of the line, at the distance of 18 or 20 inches from one another; making them all slant a little to one side in a direction parallel to the line. This being finished, let him begin at the opposite end of the line, and plant another row in the intervals between the plants of the former row; making these incline as much as the others, but in a direction exactly contrary; and then, plaiting these basket-ways, work them into lozenges like a net, fastening the tops by plaiting the small twigs with one another, which with very little trouble may be made to bind together very firmly. The whole, when finished, assumes a very beautiful net-like appearance, and is even at first a tolerable good defence; and, as these plants immediately take root and quickly increase in size, it becomes, after a few years, a very strong fence which nothing can penetrate. This kind of hedge I myself have employed; and find that a man may plant and twist properly about a hundred yards in a day, if the plants be laid down to his hand: and in a situation such as I have described, I know no kind of fence which could be reared at such a small expence so quickly become a defence, and continue so long in good order. But it will be greatly improved by putting a plant of eglantine between each two plants of willow, which will quickly spring up and be supported by them; and, by its numerous prickles, would effectually preserve the defenceless willow from being browsed upon by cattle.

"As it will be necessary to keep the narrow ridge, upon which the hedge is planted, in culture for one year at least, that the plants of eglantine may not be choked by weeds, and that the roots of the willow may be allowed to spread with the greater ease in the tender mould produced by this means, it will be proper to stir the earth once or twice by a gentle horse-hoe in

the beginning of summer; and, in the month of June, it may be sowed with turnips, or planted with coleworts, which will abundantly repay the expence of the fallow."

The same author also gives the following useful directions for planting hedges in situations very much exposed to the weather, and recovering them when on the point of decaying. "Those who live in an open uncultivated country, have many difficulties to encounter, which others who inhabit more warm and sheltered regions never experience; and, among the difficulties, may be reckoned that of hardly getting hedges to grow with facility. For, where a young hedge is much exposed to violent and continued gusts of wind, no art will ever make it rise with so much freedom, or grow with such luxuriance, as it would do in a more sheltered situation and favourable exposure.

"But although it is impossible to rear hedges in this situation to so much perfection as in the others, yet they may be reared even there, with a little attention and pains, so as to become very fine fences.

"It is adviseable in all cases, to plant the hedges upon the face of a bank; but it becomes absolutely necessary in such an exposed situation as that I have now described: for the bank, by breaking the force of the wind, screens the young hedge from the violence of the blast, and allows it to advance, for some time at first, with much greater luxuriance than it otherwise could have done.

"But as it may be expected soon to grow as high as the bank, it behoves the provident husbandman to prepare for that event, and guard, with a wise forecast, against the inconvenience that may be expected to arise from that circumstance.

"With this view, it will be proper for him, instead of making a single ditch, and planting one hedge, to raise a pretty high bank, with a ditch on each side of it, and a hedge on each face of the bank; in which situation, the bank will equally shelter each of the two hedges while they are lower than it; and, when they at length become as high as the bank, the one hedge will in a manner afford shelter to the other, so as to enable them to advance with much greater luxuriance than either of them would have done singly.

"To effectuate this still more perfectly, let a row of service trees be planted along the top of the bank, at the distance of 18 inches from each other, with a plant of eglantine between each two services. This plant will advance, in some degree, even in this exposed situation; and by its numerous shoots, covered with large leaves, will effectually screen the hedge on each side of it, which, in its turn, will receive some support and shelter from them; so that they will be enabled to advance all together, and form, in time, a close, strong, and beautiful fence.

"The service is a tree but little known in Scotland; although it is one of those that ought perhaps to be often cultivated there in preference to any other tree whatever, as it is more hardy, and, in an exposed situation, affords more shelter to other plants than almost any other tree known: for it sends out a great many strong branches from the under part of the stem, which, in time, assume an upright direction, and continue to advance with vigour, and carry many leaves to the

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Of planting
hedges in
exposed si-
tuations,
and reco-
vering
them when
decayed.
Vol. ii.
p. 16, &c.

Fences. the very bottom, almost as long as the tree exists: so that if it is not pruned, it rises a large close bush, till it attains the height of a forest tree.

"It is of the same genus with the rawn-tree, and has a great resemblance to it both in flower and fruit; its branches are more waving and pliant; its leaves undivided, broad, and round, somewhat resembling the elm, but white and mealy on the under side. It deserves to be better known than it is at present.

"But if, from the pooriness of the soil in which your hedge is planted, or from any other cause, it should so happen, that, after a few years, the hedge becomes sickly, and the plants turn poor and stunted in appearance, the easiest and only effectual remedy for that disease, is to cut the stems of the plants clean over, at the height of an inch or two above the ground; after which they will send forth much stronger shoots than they ever would have done without this operation. And if the hedge be kept free of weeds, and trained afterwards in the manner above described, it will, in almost every case, be recovered, and rendered fresh and vigorous.

"This amputation ought to be performed in autumn, or the beginning of winter; and in the spring, when the young buds begin to show themselves, the stumps ought to be examined with care, and all the buds be rubbed off, excepting one or two of the strongest and best placed, which should be left for a stem. For if the numerous buds that spring forth round the stem are allowed to spring up undisturbed, they will become in a few years as weak and stunted as before; and the hedge will never afterwards be able to attain any considerable height, strength, or healthfulness.—I have seen many hedges, that have been repeatedly cut over, totally ruined by this circumstance not having been attended to in proper time.

"If the ground for sixteen or twenty feet on each side of the hedge be fallowed at the time that this operation is performed, and get a thorough dressing with rich manures, and be kept in high order for some years afterwards by good culture and meliorating crops, the hedge will prosper much better than if this had been omitted, especially if it had been planted on the level ground, or on the bank of a shallow ditch."

⁶³⁶ **ack alder.** Mr Millar greatly recommends the black alder as superior to any other that can be employed in moist soils. It may either be propagated by layers or truncheons about three feet long. The best time for planting these last is in February or the month of March. They ought to be sharpened at their largest end, and the ground well loosened before they are thrust into it, lest the bark should be torn off, which might occasion their miscarriage. They should be set at least two feet deep, to prevent their being blown out of the ground by violent winds after they have made strong shoots; and they should be kept clear of tall weeds until they have got good heads, after which they will require no farther care. When raised by laying down the branches, it ought to be done in the month of October; and by that time twelvemonth they will have roots sufficient for transplantation, which must be done by digging a hole and loosening the earth in the place where the plant is to stand. The young sets must be planted at least a foot and a half deep; and their tops should be cut off to within about nine inches

of the ground; by which means they will shoot out many branches. This tree may be trained into very thick and close hedges, to the height of 20 feet and upwards. It will thrive exceedingly on the sides of brooks; for it grows best when part of its roots are in water; and may, if planted there, as is usual for willows, be cut for poles every fifth or sixth year. Its wood makes excellent pipes and staves; for it will last a long time under ground or in water: and it is likewise in great estimation among plough-wrights, turners, &c. as well as for making several of the utensils necessary for agriculture. Its bark also dyes a good black.

The birch is another tree recommended by Mr Mil-⁶³⁷ler as proper for hedges; and in places where the young plants can be easily procured, he says that the plantation of an acre will not cost 40 shillings, the after expence will not exceed 20 shillings: so that the whole will not come above three pounds. Ash trees ought never to be permitted in hedges, both because they injure the corn and grass by their wide extended roots, and likewise on account of the property their leaves have of giving a rank taste to butter made from the milk of such cattle as feed upon the leaves. No ash trees are permitted to grow in the good dairy-counties.

Where there are plenty of rough flat stones, the ⁶³⁸Of hedges fences which bound an estate or farm are frequently raised on the top of stone fences. made with them. In Devonshire and Cornwall it is common to build as it were two walls with these stones laid upon one another; first two and then one between: as the walls rise they fill the intermediate space with earth, beat the stones in flat to the sides, which makes them lie very firm, and so proceed till the whole is raised to the intended height. Quick hedges, and even large timber trees, are planted upon these walls, and thrive exceeding well. Such inclosures are reckoned the best defence that can be had for the ground and cattle; though it can scarcely be supposed but they must be disagreeable to the eye, and stand in need of frequent repairs, by the stones being forced out of the way by cattle. The best way to prevent this is to build such wall in the bottom of a ditch made wide enough on purpose, and sloped down on each side. Thus the deformity will be hid; and as the cattle cannot stand to face the wall so as to attempt to leap over it, the stones of which it is composed will be less liable to be beaten down. The earth taken out of the ditch may be spread on the adjacent ground, and its sides planted with such trees or underwood as will best suit the soil. By leaving a space of several feet on the inside for timber, a supply of that valuable commodity may be had without doing any injury to the more valuable pasture.

The following is an excellent method of making a ⁶³⁹Method of durable and beautiful fence in grassy places. Dig construct- pieces of turf four or five inches thick, the breadth of an ex- the spade, and about a foot in length. Lay these turfs fence in even by a line on one side, with the grass outward, at grassy pla- the distance of ten or twelve inches within the mark-ces. at which the ditch afterwards to be dug in the solid ground is to begin. Then lay, in the same manner, but with their grass sides turned out the contrary way, another row of turfs, at such a distance as to make a breadth of foundation proportioned to the intended height

Fences.

height of the bank. Thus, even though the ground should prove defective, the bank would be prevented from giving way. A ditch may then be dug of what depth and breadth you please; or the ground may be lowered with a slope on each side; and in this case there will be no loss of pasture by the fence; because it may be sowed with hay-seeds, and will bear grass on both sides. Part of the earth taken out of the ditches or slopes will fill the chasm between the rows of turf, and the rest may be scattered over the adjacent ground. Three, four, or more layers of turf, may be thus placed upon one another, and the interval between them filled up as before till the bank is brought to its desired height; only observing to give each side of it a gentle slope for greater strength. The top of this bank should be about two feet and a half wide, and the whole of it filled up with earth, except a small hollow in the middle to retain some rain. Quicksets should then be planted along this top, and they will soon form an admirable hedge. By this means a bank four feet high, and a slope only two feet deep, will make, besides the hedge, a fence six feet high, through which no cattle will be able to force their way: for the roots of the grass will bind the turf so together, that in one year's time it will become entirely solid; and it will be yet much stronger when the roots of the quick shall have shot out among it. The only precautions necessary to be observed in making this bank are, 1. Not to make it when the ground is too dry; because, if a great deal of wet should suddenly follow, it will swell the earth so much as, perhaps, to endanger the falling of some of the outside; which, however, is easily remedied if it should happen. 2. If the slope be such as sheep can climb up, secure the young quicks, at the time of planting them, by a small dead hedge, either on or near the top, on both sides. If any of the quicks should die, which they will hardly be more apt to do in this than in any other situation, unless perhaps in extremely dry seasons, they may be renewed by some of the methods already mentioned.—Such fences will answer even for a park; especially if we place posts and rails, about two feet high, a little sloping over the side of the bank, on or near its top: no deer can creep through this, nor even be able to jump over it. It is likewise one of the best fences for securing cattle; and if the quicks on the banks be kept clipped, it will form a kind of green wall pleasing to the eye.

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Elms recommended.

In the first volume of the Bath Papers we find elms recommended for fences; and the following method of raising them for this purpose is said to be the best. When elm timber is felled in the spring, sow the chips made in trimming or hewing them green, on a piece of ground newly ploughed, as you would corn, and harrow them in. Every chip, which has an eye, or bud-knot, or some bark on it, will immediately shoot like the cuttings of potatoes; and the plants thus raised having no tap-roots, but shooting their fibres horizontally in the richest part of the soil, will be more vigorous, and may be more safely and easily transplanted, than when raised from seeds, or in any other method. The plants thus raised for elm fences have greatly the advantage of others; as five, six, and sometimes more, stems will arise from the same chip; and such plants, if cut down within three inches of the

ground, will multiply their side shoots in proportion, and make a hedge thicker, without running to naked wood, than by any other method yet practised. If kept clipped for three or four years, they will be almost impenetrable.

Fences.

In the second volume of the same work, we meet with several observations on quick hedges by a gentleman near Bridgewater. He prefers the white and black thorns to all other plants for this purpose; but is of opinion, that planting timber trees in them at proper intervals is a very eligible and proper method. He raised some of his plants from haws in a nursery; others he drew up in the woods, or wherever they could be found. His banks were made flat, and three feet wide at the top, with a sloping side next the ditches, which last were dug only two feet below the surface, and one foot wide at bottom. The turfs were regularly laid, with the grass downwards, on that side of the ditch on which the hedge was to be raised, and the best of the mould laid at top. The sets were straight, long, smooth, and even growing ones, planted as soon as possible after taking up. They were planted at a foot distance; and about every 40 feet young fruit-trees, or those of other kinds, such as ash, oak, elm, beech, as the soil suited them. A second row of quicksets was then laid on another bed of fresh earth at the same time, and covered with good mould; after which the bank was finished and secured properly from injuries by a dead hedge well wrought together, and fastened by stakes of oak trees, on the top of the bank at three feet distance. Wherever any of the quicksets had failed or were of a dwindling appearance, he had them replaced with fresh ones from the nursery, as well as such of the young trees as had been planted on the top of the bank; and cleared the whole from weeds. Those most destructive to young hedges are the white and black bryony, bindweed, and the traveller's joy. The root of white bryony is as big as a man's leg, and runs very deep: that of black bryony often grows to 30 feet long, and with a kind of tendrils takes hold of the root of the young quick, and chokes it. This root must be dug very deep in order to destroy it. The third is still more destructive to young quicks than the other two, overshadowing the hedge like an arbour. Its root is smaller than that of the two former, but must be dug out very clean, as the least piece left will send up fresh shoots. It is very destructive to hedges to allow cattle to browse upon them, which they are very apt to do; but where cattle of some kind must be allowed access to them, horses will do by far the least mischief.

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Observations on quick hedges.

With regard to the advantages arising from hedges, our author observes, that if they were of no farther use than as mere fences, it would be the farmer's interest to keep them up carefully; for the better they are, the more secure are his cattle and crops. But if a judicious mixture of cyder fruit-trees were planted in hedges, the profit arising from them only would abundantly repay the cost of the whole without any loss of ground. It may possibly be objected by some, that the hedges would often be hurt by the boys climbing up to get the fruit; but those who make it should remember, or be told, that the best kinds of cyder-fruit are so hard and austere at the time of their being gathered, that nobody can eat them, and even

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Cyder fruit trees recommended in hedges.

Fences.

hogs will hardly touch them. But the greatest benefit, where no fruit-trees are planted, arises from the thorns and wood which quick hedges yield for the fire and other purposes.

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Method of
raising
hornbeam
hedges in
Germany.

The author of the Essays on Husbandry recommends the hornbeam plant as one of the best yet known for making fences, according to the method practised in Germany, where such fences are common. "When the German husbandman (says he) erects a fence of this nature, he throws up a parapet of earth, with a ditch on each side, and plants his hornbeam sets in such a manner, that every two plants may be brought to intersect each other in the form of St Andrew's cross. In that part where the two plants cross each other, he gently scrapes off the bark, and binds them with straw thwartwise. Here the two plants consolidate in a kind of indissoluble knot, and push from thence horizontal slanting shoots, which form a sort of living palisado or *chevaux de frise*; so that such a protection may be called a rural fortification. The hedges being pruned annually, and with discretion, will in a few years render the fence impenetrable in every part.

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Anderson's
method of
rendering
decayed
hedges.

"It sometimes happens (says Dr Anderson) that a hedge may have been long neglected, and be in general in a healthy state, but full of gaps and openings, or so thin and straggling, as to form but a very imperfect sort of fence. On these occasions, it is in vain to hope to fill up the gaps by planting young quicks; for these would always be outgrown, choked, and starved, by the old plants: nor could it be recovered by cutting clear over by the roots, as the gaps would still continue where they formerly were. The only methods that I know of rendering this a fence are, either to mend up the gaps with dead wood, or to *plash* the hedge; which last operation is always the most eligible where the gaps are not too large to admit of being cured by this means.

"The operation I here call *plashing*, may be defined, "a wattling made of living wood." To form this, some stems are first selected, to be left as stakes at proper distances, the tops of which are all cut over at the height of four feet from the root. The straggling side-branches of the other part of the hedge are also lopped away. Several of the remaining plants are then cut over, close by the ground, at convenient distances; and the remaining plants are cut perhaps half through, so as to permit them to be bent to one side. They are then bent down almost to a horizontal position, and interwoven with the upright stakes, so as to retain them in that position. Care ought to be taken that these be laid very low at those places where there were formerly gaps; which ought to be farther strengthened by some dead stakes or truncheons of willows, which will frequently take root in this case, and continue to live. And sometimes a plant of eglantine will be able to overcome the difficulties it there meets with, strike root, and grow up so as to strengthen the hedge in a most effectual manner.

"The operator begins at one end of the field, and proceeds regularly forward, bending all the stems in one direction, so that the points rise above the roots of the others, till the whole wattling is completed to the same height as the uprights.

"An expert operator will perform this work with much greater expedition than one who has not seen it

done could easily imagine. And as all the diagonal wattlings continue to live and send out shoots from many parts of their stems, and as the upright shoots that rise from the stumps of those plants that have been cut over quickly rush up through the whole hedge, these serve to unite the whole into one entire mass, that forms a strong, durable, and beautiful fence.

"This is the best method of recovering an old neglected hedge that hath as yet come to my knowledge.

"In some cases it happens that the young shoots of a hedge are killed every winter; in which case it soon becomes dead and unsightly, and can never rise to any considerable height. A remedy for this disease may therefore be wished for.

"Young hedges are observed to be chiefly affected with this disorder; and it is almost always occasioned by an injudicious management of the hedge, by means of which it has been forced to send out too great a number of shoots in summer, that are thus rendered so small and weakly as to be unable to resist the severe weather in winter.

"It often happens that the owner of a young hedge, with a view to render it very thick and close, cuts it over with the shears a few inches above the ground the first winter after planting; in consequence of which, many small shoots spring out from each of the stems that has been cut over:—Each of which, being afterwards cut over in the same manner, sends forth a still greater number of shoots, which are smaller and smaller in proportion to their number.

"If the soil in which the hedge has been planted is poor, in consequence of this management, the branches, after a few years, become so numerous, that the hedge is unable to send out any shoots at all, and the utmost exertion of the vegetative powers enables it only to put forth leaves. These leaves are renewed in a sickly state for some years, and at last cease to grow at all—the branches become covered with fog, and the hedge perishes entirely.

"But if the soil be very rich, notwithstanding this great multiplication of the stems, the roots will still have sufficient vigour to force out a great many small shoots, which advance to a great length, but never attain a proportional thickness. And as the vigour of the hedge makes them continue to vegetate very late in autumn, the frosts come on before the tops of these dangling shoots have attained any degree of woody firmness, so that they are killed almost entirely by it; the whole hedge becomes covered with these long dead shoots, which are always disagreeable to look at, and usually indicate the approaching end of the hedge.

"The causes of the disorder being thus explained, it will readily occur, that the only radical cure is amputation: which, by giving an opportunity to begin with training the hedge anew, gives also an opportunity of avoiding the errors that occasioned it. In this case, care ought to be taken to cut the plants as close to the ground as possible, as there the stems will be less numerous than at any greater height. And particular attention ought to be had to allow very few shoots to arise from the stems that have been cut over, and to guard carefully against shortening them.

"But as the roots, in the case here supposed, will

Fences.

be very strong, the shoots that are allowed to spring from the stems will be very vigorous, and there will be some danger of their continuing to grow later in the season than they ought in safety to do; in which case, some part of the top of the shoot may perhaps be killed the first winter, which ought if possible to be prevented. This can only be effectually done by giving a check to the vegetation in autumn, so as to allow the young shoots to harden in the points before the winter approaches. If any of the leaves or branches of a tree are cut away while it is in the state of vegetation, the whole plant feels the loss, and it suffers a temporary check in its growth in proportion to the loss that it thus sustains. To check therefore the vigorous vegetation at the end of autumn, it will be prudent to choose the beginning of September for the time of lopping off all the supernumerary branches from the young hedge, and for clipping off the side-branches that have sprung out from it; which will, in general, be sufficient to give it such a check in its growth at that season, as will prevent any of the shoots from advancing afterwards. If the hedge is extremely vigorous, a few buds may be allowed to grow upon the large stumps in the spring, with a view to be cut off at this season, which will tend to stop the vegetation of the hedge still more effectually.

"By this mode of management, the hedge may be preserved entire through the first winter. And as the shoots become less vigorous every successive season, there will be less difficulty in preserving them at any future period. It will always be proper, however, to trim the sides of a very vigorous hedge for some years while it is young, about the same season of the year, which will tend powerfully to prevent this malady. But when the hedge is advanced to any considerable height, it will be equally proper to clip it during any of the winter-months, before Candlemas."

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Lord
Kames's
observa-
tions.

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Fence for a
deer-park.

Lord Kames, in his work entitled the Gentleman Farmer, gives several directions for the raising and mending of hedges considerably different from those above related. For a deer-park he recommends a wall of stone coped with turf, having laburnums planted close to it. The heads of the plants are to be lopped off, in order to make the branches extend laterally, and interweave in the form of a hedge. The wall will prevent the deer from breaking through; and if the hedge be trained eight feet high, they will not attempt to leap over. He prefers the laburnum plant, because no beast will feed upon it except a hare, and that only when young and the bush tender. Therefore, no extraordinary care is necessary except to preserve them from the hare for four or five years. A row of alders may be planted in front of the laburnums, which no hare nor any other beast will touch. The wall he recommends to be built in the following manner, as being both cheaper and more durable than one constructed entirely of stone. Raise it of stone to the height of two feet and a half from the ground, after which it is to be coped with sod as follows. First, lay on the wall, with the grassy side under, sod cut with the spade four or five inches deep, and of length equal to the thickness of the wall. Next cover this sod with loose earth rounded like a ridge. Third, prepare thin sod, cast with the paring spade, so long as to extend, beyond the thickness of the wall, two inches on each side.

With these cover the loose earth, keeping the grassy side above; place them so much on the edge, that each sod shall cover part of another, leaving only about two inches without cover: when 20 or 30 yards are thus finished, let the sod be beat with mallets by two men, one on each side of the wall, striking both at the same time. By this operation the sod becomes a compact body that keeps in the moisture, and encourages the grass to grow. Lastly, cut off the ragged ends of the sod on each side of the wall, to make the covering neat and regular. The month of October is the proper season for this operation, because the sun and wind, during summer, dry the sod, and hinder the grass from vegetating. Moist soil affords the best sod. Wet soil is commonly too fat for binding; and, at any rate, the watery plants it produces will not thrive in a dry situation. Dry soil, on the other hand, being commonly ill bound with roots, shakes to pieces in handling. The ordinary way of coping with sod, which is to lay them flat and single, looks as if intended to dry the sod and kill the grass; not to mention that the soil is liable to be blown off the wall by every high wind.

The advantages of a thorn hedge, according to our ⁶⁴⁷Advant-
author, are, that it is a very quick grower, when ⁶⁴⁸tages of
planted in a proper soil; shooting up six or seven feet ⁶⁴⁹a thorn
in a season. Though tender, and apt to be hurt by ⁶⁵⁰hedge.
weeds when young, it turns strong, and may be cut
into any shape. Even when old, it is more disposed
than other trees to lateral shoots; and lastly its prickles
make it the most proper of all for a fence. None of
these thorns ought to be planted in a hedge till five
years of age, and it is of the utmost importance that
they be properly trained in the nursery. The best
soil for a nursery, his lordship observes, is between
rich and poor. In the latter the plants are dwarfish:
in the former, being luxuriant and tender, they are
apt to be hurt during the severity of the weather; and
these imperfections are incapable of any remedy. An
essential requisite in a nursery is free ventilation. "How
common (says his lordship) is it to find nurseries in ⁶⁵¹per nursery
hollow sheltered places, surrounded with walls and ⁶⁵²for raising
high plantations, more fit for pine-apples than barren ⁶⁵³the plants.
trees! The plants thrust out long shoots, but feeble
and tender: when exposed in a cold situation they de-
cay, and sometimes die. But there is a reason for every
thing: the nurseryman's view is to make profit by sav-
ing ground, and by imposing on the purchaser tall
plants, for which he pretends to demand double price.
It is so difficult to purchase wholesome and well nursed
plants, that every gentleman farmer ought to raise
plants for himself.

"As thorns will grow pleasantly from roots, I ⁶⁵⁴Of raising
have long practised a frugal and expeditious method of ⁶⁵⁵them from
raising them from the wounded roots that must be cut ⁶⁵⁶the roots
off when thorns are to be set in a hedge. These roots, ⁶⁵⁷of old
cut into small parts, and put in a bed of fresh earth, ⁶⁵⁸hedges.
will produce plants the next spring no less vigorous
than what are produced from seed; and thus a perpet-
ual succession of plants may be obtained without any
more seed. It ought to be a rule, never to admit into
a hedge plants under five years old; they deserve all
the additional sum that can be demanded for them.
Young and feeble plants in a hedge are of slow growth;
and, besides the loss of time, the paling necessary to
secure

^{Fences.} secure them from cattle must be renewed more than once before they become a fence. A thorn hedge may be planted in every month of winter and spring, unless it be frost. But I have always observed, that thorns planted in October are more healthy, push more vigorously, and fewer decay, than at any other time. In preparing the thorns for planting, the roots ought to be left as entire as possible, and nothing cut away but the ragged parts.

⁶⁵⁰ proper method of planting. "As a thorn hedge suffers greatly by weeds, the ground where they are planted ought to be made perfectly clean. The common method of planting, is to leave eight or nine inches along a side of the intended ditch, termed a *scarsement*; and behind the *scarsement* to lay the surface soil of the intended ditch, cut into square sods two or three inches deep, its grassy surface under. Upon that sod, whether clean or dirty, the thorns are laid, and the earth of the ditch above them. The grass in the *scarsement*, with what weeds are in the moved earth, soon grow up, and require double diligence to prevent the young thorns from being choked. The following method deserves all the additional trouble it requires. Leaving a *scarsement* as above of 10 inches, and also a border for the thorns, broad or narrow according to their size; lay behind the border all the surface of the intended ditch, champed small with the spade, and upon it lay the mouldery earth that fell from the spade in cutting the said surface. Cover the *scarsement* and border with the under earth, three inches thick at least; laying a little more on the border to raise it higher than the *scarsement*, in order to give room for weeding. After the thorns are prepared by smoothing their ragged points with a knife, and lopping off their heads to make them grow bushy, they are laid fronting the ditch, with their roots on the border, the head a little higher than the root. Care must be taken to spread the roots among the surface-earth, taken out of the ditch, and to cover them with the mouldery earth that lay immediately below. This article is of importance, because the mouldery earth is the finest of all. Cover the stems of the thorns with the next stratum of the ditch, leaving always an inch at the top free. It is no matter how poor this stratum be, as the plants draw no nourishment from it. Go on to finish the ditch, pressing down carefully every row of earth thrown up behind the hedge, which makes a good solid mound impervious to rain. It is a safeguard to the young hedge to raise this mound as perpendicular as possible; and for that reason, it may be proper, in loose soil, when the mound is raised a foot or so, to bind it with a row of the tough sod, which will support the earth above till it become solid by lying. In poor soil more care is necessary. Behind the line of the ditch the ground intended for the *scarsement* and border should be summer fallowed, manured, and cleared of all grass roots; and this culture will make up for the inferiority of the soil. In very poor soil, it is vain to think of planting a thorn hedge. In such ground there is a necessity for a stone fence.

"The only reason that can be given for laying thorns as above described, is to give the roots space to push in all directions; even upwards into the mound of earth. There may be some advantages in this; but, in my apprehension, the disadvantage is much greater

of heaping so much earth upon the roots as to exclude not only the sun, but the rain which runs down the sloping bank, and has no access to the roots. Instead of laying the thorns fronting the ditch, would it not do better to lay them parallel to it; covering the roots with three or four inches of the best earth, which would make a hollow between the plants and the sloping bank? This hollow would intercept every drop of rain that falls on the bank, to sink gradually among the roots. Why, at any rate, should a thorn be put into the ground sloping? This is not the practice with regard to any other tree; and I have heard of no experiment to persuade me that a thorn thrives better sloping than erect. There occurs, indeed, one objection against planting thorns erect, that the roots have no room to extend themselves on that side where the ditch is. But does it not hold, that when, in their progress, roots meet with a ditch, they do not push onwards; but, changing their direction, push downward at the side of the ditch? If so, these downward roots will support the ditch, and prevent it from being mouldered down by frost. One thing is evident without experiment, that thorns planted erect may sooner be made a complete fence than when laid sloping as usual. In the latter case, the operator is confined to thorns that do not exceed a foot or 15 inches; but thorns five or six feet high may be planted erect; and a hedge of such thorns, well cultivated in the nursery, will in three years arrive to greater perfection than a hedge managed in the ordinary way will do in twice that time."

After the hedge is finished, it is absolutely necessary to secure it for some time from the depredations of cattle; and this is by no means an easy matter. ⁶⁵¹ Of securing a hedge after it is planted. "The ordinary method of a paling (says his lordship) is no sufficient defence against cattle: the most gentle make it a rubbing post, and the vicious wantonly break it down with their horns. The only effectual remedy is expensive; viz. two ditches and two hedges, with a mound of earth between them. If this remedy, however, be not palatable, the paling ought at least to be of the strongest kind. I recommend the following as the best I am acquainted with: Drive into the ground strong stakes three feet and a half long, with intervals from eight to twelve inches, according to the size of the cattle that are to be enclosed; and all precisely of the same height. Prepare plates of wood sawed out of logs, every plate three inches broad and half an inch thick. Fix them on the heads of the stakes with a nail driven down into each. The stakes will be united so firmly, that one cannot be moved without the whole; and will be proof accordingly against the rubbing of cattle. But, after all, it is no fence against vicious cattle. The only proper place for it is the side of a high road, or to fence a plantation of trees. It will indeed be a sufficient fence against sheep, and endure till the hedge itself becomes a fence. A fence thus completed, including thorns, ditching, wood, nails, &c. will not much exceed two shillings every six yards."

⁶⁵² Of training hedges. His lordship discommends the ordinary method of training hedges, by cutting off the top and shortening the lateral branches, in order to make it thick and bushy. This, as well as the method of cutting off the stems two or three inches above the ground, indeed, produces

Fences.

produces a great number of shoots, and makes a very thick fence, but which becomes so weak when bare of leaves, that cattle break through it in every part. To determine the best method of proceeding in this case, his lordship made an experiment on three hedges, which were twelve years old at the time he wrote. The first was annually pruned at the top and sides; the sides of the second were pruned, but not the top; and the third was allowed to grow without any pruning. The first, at the time of writing, was about four feet broad, and thick from top to bottom; but weak in the stems, and unable to resist any horned beast: the second was strong in its stems, and close from top to bottom: the third was also strong in its stems, but bare of branches for two feet from the ground; the lower ones having been deprived of air and rain by the thick shade of those above them. Hence he directs that hedges should be allowed to grow till the stems be five or six inches in circumference, which will be in ten or twelve years; at which time the hedge will be fifteen feet or more in height. The lateral branches next the ground must be pruned within two feet of the stem; those above must be made shorter and shorter in proportion to their distance from the ground; and at five feet high they must be cut close to the stem, leaving all above full freedom of growth. By this dressing the hedge takes on the appearance of a very steep roof; and it ought to be kept in that form by pruning. This form gives free access to rain, sun, and air: every twig has its share, and the whole is preserved in vigour. When the stems have arrived at their proper bulk, cut them over at five feet from the ground, where the lateral branches end. This answers two excellent purposes: the first is to strengthen the hedge, the sap that formerly ascended to the top being now distributed to the branches; the next is, that a tall hedge stagnates the air, and poisons both corn and grass near it. A hedge trained in this manner is impenetrable even by a bull.

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Plashing of
hedges dis-
commen-
ed.

With regard to the practice of *plashing* an old hedge recommended by Dr Anderson, his lordship observes that "it makes a good interim fence, but at the long run is destructive to the plants: and accordingly there is scarcely to be met with a complete good hedge where plashing has been long practised. A thorn is a tree of long life. If, instead of being massacred by plashing, it were raised and dressed in the way here described, it would continue a firm hedge perhaps 500 years.

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Hedges
ought to be
planted on
the side of
the bank,
and no
trees allow-
ed in them.

"A hedge ought never to be planted on the top of the mound of earth thrown up from the ditch. It has indeed the advantage of an awful situation; but being planted in bad soil, and destitute of moisture, it cannot thrive: it is at best dwarfish, and frequently decays and dies. To plant trees in the line of the hedge, or within a few feet of it, ought to be absolutely prohibited as a pernicious practice. It is amazing that people should fall into this error, when they ought to know that there never was a good thorn hedge with trees in it. And how should it be otherwise? An oak, a beech, an elm, grows faster than a thorn. When suffered to grow in the midst of a thorn hedge, it spreads its roots everywhere, and robs the thorns of their nourishment. Nor is this all: the tree, overshadowing the thorns, keeps the sun and air from them.

At the same time, no tree takes worse with being overshadowed than a thorn.

"It is scarcely necessary to mention gaps in a hedge, because they will seldom happen where a hedge is trained as above recommended. But in the ordinary method of training, gaps are frequent, partly by the failure of plants, and partly by the trespassing of cattle. The ordinary method of filling up gaps, is to plant sweet briar where the gap is small, and a crab where it is large. This method I cannot approve, for an obvious reason: a hedge ought never to be composed of plants which grow unequally. Those that grow fast, overtop and hurt the slow growers; and with respect, in particular, to a crab and sweet briar, neither of them thrive under the shade. It is a better method to remove all the withered earth in the gap, and to substitute fresh sappy mould mixed with some lime or dung. Plant upon it a vigorous thorn of equal height with the hedge, which in its growth will equal the thorns it is mixed with. In that view there should be a nursery of thorns of all sizes, even to five feet high, ready to fill up gaps. The best season for this operation is the month of October. A gap filled with sweet briar, or a crab lower than the hedge, invites the cattle to break through and trample the young plants under foot; to prevent which, a paling raised on both sides is not sufficient, unless it be raised as high as the hedge.

"Where a field is too poor to admit of a thorn hedge, if there be no quantity of stones easily procurable, whins are the only resource. These are commonly placed on the top of a dry earth dyke, in which situation they seldom thrive well. The following seems preferable. Two parallel ditches three feet wide and two deep, border a space of twelve feet. Within this space raise a bank at the side of each ditch with the earth that comes out of it, leaving an interval between the two banks. Sow the banks with whin seed, and plant a row of trees in the interval. When the whins are pretty well grown, the hedge on one of the banks may be cut down, then the other as soon as it becomes a fence, and so on alternately. While the whins are young, they will not be disturbed by cattle, if passages be left to go out and in. These passages may be closed up when the hedge is sufficiently strong to be a fence. A whin hedge thus managed, will last many years, even in strong frost, unless very severe. There are many whin hedges in the shire of Kincardine not so skilfully managed, and yet the possessors appear not to be afraid of frost. Such fences ought to be extremely welcome in the sandy grounds of the shire of Moray, where there is scarcely a stone to be found. The few earth fences that are there raised, composed mostly of sand, very soon crumble down."

In the fourth volume of Mr Young's Northern Tour, the author recommends the transplanting of old hedges, which his correspondent Mr Beverly says he has tried with prodigious success.

Mr Bakewell, we are told, is very curious in his fences, and plants his quicks in a different manner from what is common in various parts of the kingdom. He plants one row at a foot from set to set, and making his ditch, lays the earth which comes out of it to form a bank on the side opposite to the quick. In the common method, the bank is made on the quick side above it. Reasons are not wanting to induce a preference of this

Fences.
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Of filling
up gaps.

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In what
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sary.

Annals of
Agriculture, vol.
vi. p. 357.
ib. p. 494.
657

Mr. Bakewell's fences.

Fences. this method. The plants grow only in the surface earth uncovered from the atmosphere, which must necessarily be a great advantage; whereas, in the usual way of planting, that earth, which is always the best, is loaded by a thick covering obliquely of the earth out of the ditch. If the roots shoot in the best soil, they will be out of the reach of the influences of the air; the consequence of which is, that they cannot have so large a space of that earth as if set on the flat. The way to have a tree or a quick thrive in the best manner possible, is to set it on the surface without any ditch or trench, that cuts off half its pasture. But if a ditch is necessary, the next best way must of course be still to keep it on the flat surface; and the worst way to cover up that surface, by loading it with the dead earth out of a trench. To say that there are good hedges in the common method is not a conclusive argument, unless both were tried on the same soil and exposure.

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of hedges
stony
and gravel-
soils.

In the 7th volume of the same work, a correspondent, who signs himself M. M. observes, that notwithstanding all the improvements that have been made in the construction of hedges and fences, there are many soils in England, which, from their sandy and gravelly natures, are little adapted to any of the plants in common use, and are therefore subject to all the inconveniences of dead hedges and gaps. Of this kind are all the sandy and gravelly inclosures, which constitute so large a part of many districts in the island. For these our author recommends a triple row of furze; though, notwithstanding its advantages, he says it is liable to be destroyed by severe winters, contrary to the assertion of Lord Kames above related. "It is liable (says he) to be so completely cut off by a severe winter, that I have seen tracts of many hundred acres laid open in the space of a few weeks, and reduced to as defenceless a state as the surrounding wastes. On such soils therefore he recommends the holly; the only disadvantage of which, he says, is its slow growth. On most of these soils also the black thorn will rise spontaneously; and even the quick, though slowly, will advance to a sufficient degree of perfection. The birch, however, he particularly recommends, as growing equally on the driest and on the wettest soils, propagating itself in such numbers, that, were they not destroyed, all the sandy wastes of this kingdom would be quickly covered with them. He recommends particularly the keeping of a nursery for such plants as are commonly used for hedges. "I generally (says he) pick out a bit of barren land, and after ploughing it three or four times to bury and destroy the heath, I find it answer extremely well for a nursery. Into this spot I transplant quick hollies, and every tree which I use for fences or plantations. By establishing such a nursery, a gentleman will always be able to command a sufficiency of strong and hardy plants which will not deceive his expectations. I look upon thorns of five or six years old, which have been twice transplanted from the seed-bed, to be the best of all; but as it may be necessary to fill up casual gaps in hedges that have been planted several years, a provision should be made of plants of every age, to twelve or fourteen years old. All plants which are intended to be moved, should be transplanted every two, or at most three years; without this attention, they attach

themselves so firmly to the soil as renders a subsequent operation dangerous. All who transplant quicks or hollies ought to begin their labours as early as convenient in the autumn; for I have found, by repeated experience, that neither of these plants succeed so well in the spring."

When the fences of a tract of ground are in a very ruinous condition, it is absolutely necessary to scour the ditches, throw up the banks, and secure the whole immediately by the firmest dead fences we can procure. If there is a total want of living plants, the cultivator can do nothing but plant new hedges; but if, as is generally the case, the banks are furnished with a multitude of old stems, though totally unconnected as a fence, the time and labour requisite for the intended improvement will be considerably abridged. All the straggling branches which add no solidity to the fence are to be cut off; after which the rest of the stems must be shortened to the height of three or four feet. The method of cutting down every thing to the ground, which is now so general, our author highly condemns. "Such a fence (says he) has within it no principle of strength and connection; it is equally exposed in every part to depredations of cattle and sportsmen: and even should it escape these, the first fall of snow will nearly demolish it. On the contrary, wherever these vegetable palisades can be left, they are impenetrable either for man or horse, and form so many points of union which support the rest."

Another method of strengthening defective fences is, to bend down some of the lateral shoots in a horizontal direction, and to spread them along the line of the fence, like espalier trees in a garden. A single stem, when it rises perpendicularly, will not secure a space of more than two or three feet, but when bent longitudinally, it will form a barrier at least sufficient to repel all cattle but hogs for twelve or fourteen on one side. By bending down, our author does not mean the common *plashing* method, which is very injurious to the plants; but the spreading two or three of the most convenient branches along the hedge, and fastening them down either by pegs or tying, without injury to the stem, until they habitually take the proposed direction. Those who make the experiment for the first time will be astonished how small a number of plants may be made to fill a bank, with only trifling intervals. The birch is particularly useful for this purpose; being of so flexible a nature, that shoots of ten or twelve feet in length may be easily forced into a horizontal direction; and if the other shoots are pruned away, all the juices of the plant will be applied to nourish the selected few: by which means they will in a few years acquire all the advantages of posts and rails, with this material difference, that instead of decaying, they become annually better. It is besides the property of all inclined branches to send up a multitude of perpendicular shoots; so that by this horizontal inclination, if judiciously made, you may acquire almost all the advantages of the thickest fence; but when the stems are too old and brittle to bear this operation, it will be adviseable to cut off all the useless ones close to the ground, and next spring they will be succeeded by a number of young and vigorous ones. Select the best of these to be trained in the manner already directed, and extirpate all the rest, to increase their

Fences.

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Of repair.
ing ruinous
hedges.

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Plashing of
the hedges dis-
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a proper
nursery.

Fences.

their vigour. The shoots of such old stems as have been just now described, will attain a greater size in three or four years than any young ones that can be planted will do in twelve.

662
Of thickening hedges by laying down the young shoots.

Another method which our author has practised with the greatest success is the following. The tender shoots of most trees, if bended downwards and covered with earth, will put forth roots, and being divided from the parent stem at a proper time, become fresh plants; an operation well known to gardeners, under the name of *laying*. This may be as advantageous to the farmer, if he will take the very moderate trouble of laying down the young and flexible branches in his fences. Most species of trees, probably all, will be propagated by this method, but particularly the withy; the birch, the holly, the white thorn, and the crab, will also take root in this method, though more slowly; the latter being an excellent plant for fences, and not at all nice in the soil on which it grows. The advantage of laying down branches in this manner over the planting of young ones is, that when you endeavour to fill up a gap by the latter method, they advance very slowly, and are in danger of being stifled by the shade of the large trees; whereas, if you fortify a gap by spreading the branches along it in the manner just mentioned, and at the same time insert some of the most thriving shoots in the ground, they will advance with all the vigour of the parent plant, and you may allow them to grow until they are so fully rooted as to be free from danger of suffocation.

663
In what case the cutting down of hedges is proper.

It frequently happens, that the fences of an estate have been neglected for many years, and exhibit nothing but ragged and deformed stems at great intervals. In this case it will be proper to cut them all off level with the ground: the consequence of this is, that next year they will put forth a great number of shoots, which may be laid down in every direction, and trained for the improvement of the fence. When this operation is performed, however, it ought always to be done with an axe, and not with a saw; it being found that the latter instrument generally prevents the vegetation of the plant. All the shoots laid down in this manner should be allowed to remain for several years, that they may be firmly rooted. Thus they will make prodigious advances; and it is to be observed, that the more the parent plant is divested of all superfluous branches, the greater will be the nourishment transmitted to the scions.

Our author, however, is inclined to suspect that the most perfect form of a hedge, at least in all but those composed of thorns and prickly plants, is to train up as many stems as will nearly touch each other. The force of every fence consists chiefly in the upright stems: where these are sufficiently near and strong, the hedge resists all opposition, and will equally repel the violence of the bull, and the insidious attacks of the hogs. It is absolutely proper that all hedges should be inspected once a-year; when not only the ditch ought to be thrown out, and the bank supported, but the straggling shoots of all the live plants ought to be pruned. By these are meant all such as project over the ditch beyond the line of the hedge, and which add nothing to its strength, though they deprive the useful stems of part of their nourish-

ment. Where a hedge is composed of plants of inferior value, it will be proper to train those in the manner just now recommended, and to plant the bank with quick or holly. When these last have attained a sufficient size, the others may be extirpated; which is best done by cutting down all the shoots repeatedly in the summer, and leaving the roots to rot in the hedge.

In the 13th volume of the Annals, W. Erskine, Esq. gives an account of a method of fencing very much resembling that recommended by Lord Kames, and which has been already described. That gentleman is of opinion, that in some cases *dead stone walls*, as they are called, are more advantageous than hedges. "That hedges (says he) are more ornamental, cannot be denied; and they are generally allowed to afford more shelter: but the length of time, the constant attention, and continual expence of defending them until they bear even the resemblance of a fence, induces many people, in those places where the materials are easily procured, to prefer the dry stone walls; for though the first cost is considerable, yet as the farmer reaps the immediate benefit of the fence (which is undoubtedly the most secure one), they are thought on the whole to be the least expensive; besides, the cattle in exposed situations, and especially in these northern parts, are so impatient of confinement at the commencement of the long, cold, wet nights, that no hedges I have ever yet seen, in any part of this island, are sufficient to keep them in."

664
Mr Erskine's method of constructing hedges.

From considerations of this kind, the late Sir George Suttie of East Lothian was induced to think of a fence which might join the strength of the wall to the ornament of the hedge. His thorns were planted in the usual manner on the side of the ditch: but instead of putting behind them a post and rail or paling on the top of the bank, he erected a wall two feet and a half high; and being well situated for procuring lime, he used it in the construction of these walls, which Mr Erskine greatly recommends; "as the satisfaction they afford, by requiring no repairs, and the duration of them, more than repay the expence: but where the price of lime is high they may be built without any cement, and answer the purpose very well if the work is properly executed."

In making a new fence of this kind, the surface of the ground should be pared off the breadth of the ditch, and likewise for two feet more, in order to prevent as much as possible the thorns from being injured by the growth of grass and weeds. The ditch should be five feet broad, two and a half in depth, and one foot broad at the bottom. Leave one foot for an edging or scarsement, then dig the earth one spit of a spade for about one foot, and put about three inches of good earth below the thorn, which should be laid nearly horizontal, but the point rather inclining upwards, in order to let the rain drip to the roots; then add a foot of good earth above it: leave three or four inches of a scarsement before another thorn is planted; it must not be directly over the lower one, but about nine inches or a foot to one side of it; then throw a foot of good earth on the thorn, and trample it well down, and level the top of the bank for about three feet and a half for the base of the wall to rest on. This base should be about nine or ten inches, but must not exceed

Fences. exceed one foot from the thorn. The wall ought to be about two feet thick at the bottom and one foot at the top: the cope to be a single stone laid flat; then covered with two sods of turf, the grass of the undermost to be next the wall, and the other sod must have the grass side uppermost. The sods should be of some thickness, in order to retain moisture; so that they may adhere together, and not be easily displaced by the wind. The height of the wall to be two feet and a half, exclusive of the sods; which together should be from four to six inches, by which means the wall would be near to three feet altogether. The expence of the fences cannot so easily be counted, on account of the differences of the prices of labour in different parts. Mr Erskine had them done with lime, every thing included, from 10½d. to 13d. per ell (which is equal to 37 inches 2 parts), according to the ease or difficulty of working the quarry, and the distance of it from the place where the fence is erected. The lime is about 6d. per boll of about 4.0872667 bushels; and from 15 to 16 bolls of lime are used to the rood of 35 square ells Scots measure; and there are upwards of 43 Scots ells, or 44 English yards. When the common round or flint stones are made use of, as they require more lime, it is necessary to use 30 or 35 bolls of lime to the rood. The thorns are sold from five to ten shillings per thousand, according to their age, reckoning six score to the hundred. Making the ditch, laying the thorns, and preparing the top of the wall, generally cost from 7d. to 8d. every six ells. About 50 carts of stones, each cart carrying from seven to nine cwt. will build a rood; the carriage at 2d. per cart for half a mile's distance.

Warmth is undoubtedly extremely beneficial to hedges; and the walls give an effectual shelter, which in exposed situations is absolutely necessary for rearing young hedges; and they likewise preserve a proper degree of moisture about the roots. If the hedges have been planted for six or seven years before the wall is built, cut them over to two or three inches above the ground with a sharp tool, either in October or November, or early in the spring; and erect the wall as quickly in that season as possible (the spring in this country can scarcely be said to begin till the end of March). It is almost impossible to imagine the rapidity with which hedges grow in favourable situations. Mr Erskine had one cut over in the spring, and by the end of the year it was almost as high as the wall. In three years he supposed, that not even the Highland sheep, who easily overleap a wall of four feet and a half in height, would have been able to break through it.

665 Notwithstanding the reasons that have been given already against the planting of timber trees in hedges, we find the practice recommended by some authors as one of the best situations for raising ship-timber. The reasons are, that the roots have free range in the adjoining inclosures, and the top is exposed to the exercise of the winds; by which means the trees are at once enabled to throw out strong arms, and have a large spreading head at the same time; so that we thus at once obtain quickness of growth with strength and crookedness of timber. Well trained timber trees it is alleged are not prejudicial to hedges, though pollards and low spreading trees are destructive to the

hedge-wood which grows under them; neither are high trees prejudicial to corn-fields like high hedges and pollards, which prevent a proper circulation of air; and in Norfolk, where the cultivation of grain is carried on in great perfection, such lands are said to be *wood-bound*. But when a hedge is trimmed down to four or five feet high, with oaks interspersed, a circulation of air is rather promoted than retarded by it: and a trimmed hedge will thrive quite well under tall stemmed trees, particularly oaks. For arable inclosures, therefore, hedges are recommended of four or five feet high, with oak-timbers from 15 to 25 feet stem. Higher hedges are more eligible for grass-lands: the grasses affect warmth, by which their growth is promoted, and consequently their quantity is increased, though perhaps the quality may suffer some injury. A tall fence likewise affords shelter to cattle, provided it be thick and close at the bottom; but otherwise, by admitting the air in currents, it does rather harm than good. The shade of trees is equally friendly to cattle in summer: for which reason it is recommended in grass inclosures to allow the hedge to make its natural shoots, and at the same time to have oak trees planted in it at proper intervals. Upon bleak hills, and in exposed situations, it will be proper to have two or even three rows of hedge-wood, about four feet distant from each other; the middle row being permitted to reach, and always to remain at, its natural height: whilst the side rows are cut down alternately to give perpetual security to the bottom, and afford a constant supply of materials for dead hedges and other purposes of under-wood.

666 Much has been said of the excellency of the holly as a material for hedges; and indeed the beauty of the plant, with its extreme closeness, and continuing green throughout the winter, evidently give it the preference to all others; and could it be raised with equal ease, there is no doubt that it would come into universal practice. Besides the above properties, the holly will thrive almost upon any soil; but thin-soiled stony heights seem to be its natural situation; and it may properly enough be said, that holly will grow wherever corn will. Its longevity is likewise excessive; and being of slow growth, it does not *suck the land*, as the farmers express it, or deprive the crop of its nourishment, as other hedges do. The difficulty of raising holly may be obviated by planting it under crabs, which have a tendency to grow more upright than hawthorns, and consequently affording more air, will not impede its progress though they afford shelter. It may even be raised alone without any great difficulty; only in this case the dead fence, to secure it, must be kept up at least ten or twelve years, instead of six or seven, as in the other case; and indeed, considering the advantages to be derived from fences of this kind, they seem to merit all the additional trouble requisite.

The holly may be raised either under the crab or hawthorn in two ways, viz. by sowing the berries when the quick is planted, or by inserting the plants themselves the ensuing midsummer. The former is by much the more simple, and perhaps upon the whole the better method. The seeds may either be scattered among the roots of the deciduous plants, or be sown in a drill in front: and if plants of holly

^{Fences.} be put in, they may either be planted between those of the crab, or otherwise in front in the quincunx manner.

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Hedges of
whins or
furze.

“Whins (furze) have been often employed, says Dr Anderson, as a fence, when sown upon the top of a bank. They are attended with the convenience of coming very quickly to their perfection, and of growing upon a soil on which few other plants could be made to thrive; but in the way that they are commonly employed, they are neither a strong nor a lasting fence. The first of these defects may, in some measure, be removed, by making the bank upon which they are sowed (for they never should be transplanted) of a considerable breadth; in order that the largeness of the aggregate body, considered as one mass, may, in some measure, make up for the want of strength in each individual plant. With this view, a bank may be raised of five or six feet in breadth at the top, with a large ditch on each side of it; raising the bank as high as the earth taken from the ditches will permit; the surface of which should be sowed pretty thick with whin seeds. These will come up very quickly: and in two or three years will form a barrier that few animals will attempt to break through, and will continue in that state of perfection for some years. But the greatest objection to this plant as a fence is, that, as it advances in size, the old prickles always die away; there being never more of these alive at any time upon the plant, than those that have been the produce of the year immediately preceding; and these thus gradually falling away, leave the stems naked below as they advance in height; so that it very soon becomes an exceeding poor and unsightly fence; the stems being entirely bare, and so slender withal as not to be able to make a sufficient resistance to almost any animal whatever. To remedy this great defect, either of the two following methods may be adopted. The first is to take care to keep the bank always stored with young plants; never allowing them to grow to such a height as to become bare below; and it was principally to admit of this, without losing at any time the use of the fence, that I have advised the bank to be made of such an unusual breadth. For if one side of the hedge be cut quite close to the bank, when it is only two or three years old, the other half will remain as a fence till that side become strong again; and then the opposite side may be cut down in its turn; and so on alternately as long as you may incline: by which means the bank will always have a strong hedge upon it without ever becoming naked at the root. And as this plant, when bruised, is one of the most valuable kinds of winter food yet known for all kinds of domestic animals, the young tops may be carried home and employed for that purpose by the farmer; which will abundantly compensate for the trouble of cutting, and the waste of ground that is occasioned by the breadth of the bank.

“The other method of preserving a hedge of whins from turning open below, can only be practised where sheep are kept; but may be there employed with great propriety. In this case it will be proper to sow the seeds upon a conical bank of earth, shoved up from the surface of the ground on each side without any ditches. If this is preserved from the sheep for two or three years at first, they may then be allowed free access to

it; and, as they can get up close to the foot of the bank upon each side, if they have been accustomed to this kind of food, they will eat up all the young shoots that are within their reach, which will occasion them to send out a great many lateral shoots: and these being continually browsed upon, soon become as close as could be desired, and are then in no sort of danger of becoming naked at the root, although the middle part should advance to a considerable height.

Where furze or whins are to be used either as a fence by themselves, or in assistance to another, it is perhaps more proper to use the French seed than that produced in Great Britain, as the former seldom ripens in this country, and consequently cannot like the latter overrun the adjacent inclosure. It may be had at the seedshops in London for about 15d. per pound, and one pound will sow 40 statute roods. When used as an assistant to a hedge, it is more proper to sow it on the back of the bank than on the top of it; as in this case it is more apt to overhang the young plants in the face of the bank; whilst in the other it is better situated for guarding the bank, and preventing it from being torn down by cattle. The method of sowing is as follows: Chop a drill with a sharp spade about two-thirds of the way up the back of the bank, making the cleft gape as wide as may be without breaking off the lip; and having the seed in a quart bottle, stopped with a cork and goose quill, or with a perforated wooden stopper, trickle it along the drill, covering it by means of a broom drawn gently above and over the mouth of the drill. Closing the drill with the back of the spade, shuts up the seeds too much from the air, and thus keeps them too long from rising.

We do not know that any person has yet attempted to make use of the gooseberry for the purpose of making hedges, though few plants seem better adapted for that purpose. It grows readily. Some varieties of it rise to a considerable height, and by the strength and number of its prickles, it would effectually prevent any animal from breaking through.—It is said that some species of the mulberry not only grow and thrive in England, but are capable of being reared to perfection in Scotland, as has been experienced at Dalkeith. As the leaves of this plant are the food of the silk-worm, which produces the most beautiful and valuable of all the materials that can occupy the loom, it is perhaps worthy of attention how far it might be worth while to rear it as a fence in hedge-rows, with a view to its becoming the basis of a valuable manufacture.

Dry stone walls are sometimes erected of those round and apparently water-worn stones which the plough throws out, and which may be gathered in every field. They are usually coped with sod. This, however, is a very indifferent fence. In most instances it is erected by common labourers, and is therefore ill constructed, so as not even to be of an uniform thickness from top to bottom. The round figure of the stones also prevents the building from being well bound together. Even the cattle rubbing themselves against it are apt to make considerable gaps, which render constant attention necessary to keep it in repair. It is cheaply executed, however, and affords the means of at once fencing the land and clearing it of stones. When dry stone walls are skillfully built by

^{Fences.}

⁶⁶⁸
Gooseberry
hedge.

⁶⁶⁹
Fences of
stone wall.

Fences. by masons, and made with quarried stones finished with a good coping, they look well and last for many years; but the coping ought to be of stone and not of turf or mud.

To render stone and lime walls valuable as fences, they should have a broad base, and have a foundation sufficiently deep to prevent their being injured by the loosening of the soil which is produced by frost. This fence is very durable, but it is also very expensive. To be in perfection, it ought to be executed not with common stones gathered from the fields, but with stones from the quarry: It ought to be secured at the top with a coping of stone of the flag kind, laid together in such a way as to render the wall narrow at top like the roof of a house. If the coping is neglected, the moisture soon finds its way into the heart of the wall, and it is also liable to various accidents from idle persons climbing over it.

⁶⁷⁰ **the Galloway dike.** The Galloway dike owes its name to the county in which it was first used. It consists of a broad building of dry stones tapering upwards. Large flat stones are then laid on like a coping, and project over the wall on each side. Above these stones large rugged round stones are laid, and smaller stones above these, so as to admit a free passage to the winds which whistle through them. The Galloway dike is never raised very high, but its tottering appearance so terrifies the cattle and sheep, that they dare not touch it; so that it is a very effectual fence, though it neither affords shelter nor ornament to the country. It has the advantage, however, of being erected at a very trifling expence; it is not unsuitable to those lower parts of the country in which the shelter of high trees and hedges would prove pernicious to the corn crop, and where the confinement of the stock is all that is required.

Clay is sometimes used instead of lime for binding stone-walls; but it is a very defective cement: for if frost suddenly succeed to wet weather, it is apt to swell and to tumble down at the next thaw. To guard against the effects of moisture, these stone and clay walls are sometimes rough-cast or coated over with lime. If the coating is very thick and the wall properly coped, it may last in this way as long as a wall of stone and lime.

For the sake of the appearance, dry-stone walls have sometimes two or three inches at the top of them on each side lipped or washed with lime, which adds nothing to their strength, but gives them the appearance of being built entirely with stone and lime. With the same view, and with the same effect, they are sometimes also broad-cast or coated with lime over their whole surface. Dry-stone walls after they are finished are sometimes pinned and harled, or rough-cast, that is, the mason fills up all the interstices of the building with small stones, and afterwards coats it over with lime, which adds considerably to its durability.

Low dry-stone walls have sometimes a light paling at the top, which gives them a handsome appearance.

Brick walls are sometimes used where stones are extremely scarce, but they are chiefly employed for facing garden walls.

⁶⁷¹ **me ls.** Frame walls are constructed in the following manner. A frame of boards of the width and height intended for the future wall is placed upon the line that has been dug for a foundation. The frame is filled to

the top with stones gathered from the adjoining fields, and a quantity of liquid mortar is poured in amongst them sufficient to fill up every interstice. The whole is allowed to remain for a day or two, or longer, till the building is dried so far as to have acquired some stability. The frame is then removed, and placed a little farther on in the same line, but in contact with the last-made piece of wall, and the operation is renewed. This is supposed to have been a very ancient mode of building.

Turf walls are found very useful in upland districts for temporary purposes, such as for folds, or for protecting young plantations or young hedges. Their strength is sometimes increased, without augmenting the expence of the construction, by intermingling them with stones, that is, by forming the wall of alternate layers of turf and stone.

⁶⁷² **Mud walls.** Mud walls, with a mixture of straw, are very frequent in many places both of England and Scotland, and they are used not only for fences, but also for constructing the walls of farm houses and offices, in the poorer parts of the country. They are formed in the following manner. Straw and clay are incorporated with each other, like hair with plaster lime, and formed into large pieces. A stratum of these is laid at the bottom of the intended wall. The different pieces are then firmly kneaded with the hand, and pressed at each side with a flat board, which not only consolidates, but gives smoothness and uniformity to the work. Successive strata are added till the wall is reared to its intended height. If walls thus constructed are properly coated with lime, to protect them against moisture, they become very durable; and their appearance is not inferior to that of a stone and lime building.

⁶⁷³ **Compound fences.** Of compound fences, the most ordinary is the single hedge and ditch, with or without paling. The mode of planting these hedges has been already stated on the authority of Lord Kames and others; and we shall only add, that if a hedge is wished to rise with rapidity, the spot in which it is planted ought to be enriched with lime, compost, or other manures, as hedge plants cannot, any more than other plants, spring rapidly without cultivation. When a hedge is planted at the top of a ditch, it may also be remarked, that it is doubly necessary to give the ditch a proper degree of slope, that it may not be undermined by any accident, which would have the effect to lay bare the roots of the hedge, or entirely to bring it down. Where it is wished to render lands inclosed with hedge and ditch fencible at once, a kind of Galloway dike, consisting of some rows of large coarse loose stones, may be placed upon the top of the bank, which will have the effect of protecting the hedge against cattle.

The double ditch, with a hedge in the front of each, is now practised, particularly on cold lands, in many parts of Great Britain. It may be remarked, that where these double ditches are wanted for drains, it is undoubtedly a proper practice; but in other situations it is exceptionable, as laying out unprofitably a large portion of the soil.

When a hedge and ditch is used, whether single or double, the hedge is sometimes placed not at the bottom of the bank, which is the usual way, but in the middle of it, at some height above the ordinary surface of the field. In such a mode of planting, the hedge is exposed

Fences.

exposed to great injury from the bank mouldering down, and from want of proper nourishment; but the practice is sometimes necessary upon wet lands, where hedges would not thrive, if placed upon the common surface. Sometimes the face of a natural declivity is cut down, in a sloping direction, to within 18 or 20 inches of the bottom. Here a bed is made and covered with good earth, in which the plants are inserted. A hedge planted in this way looks formidable from the side facing the bank; but it is exposed to more accidents, from a failure of its soil in consequence of frosts, than if planted at the bottom of the banks.

674
Hedge and
bank fences

Sometimes what is called a hedge and bank, or hedge on the top of a bank, is made use of. It consists of a bank of earth taken from the adjoining grounds, broad at bottom and tapering towards the top, along the summit of which the hedge is planted. Such hedges are extremely liable to decay, in consequence of the artificial mound, on which they stand, being unable to retain sufficient moisture for their support, or being washed away from about their roots.

675
Devonshire
fences.

The Devonshire fence resembles the one now described. It consists of an earthen mound seven feet wide at bottom, and four at the top, and five feet in height. In the middle of the top of it a row of quicks is planted, and on each side at two feet distance a row of willow stakes, of about an inch in diameter each, and from 18 inches to two feet in length, is stuck in, sloping a little outwards. These stakes take root, and form a kind of live fence for the preservation of the quicks in the middle.

Palings are frequently employed for the protection of young hedges, whether planted on the plain soil or on the top of a ditch: dead hedges, of the kinds formerly mentioned, are also employed for the same purpose. The dead hedge is preferable to the paling, as it shelters the young plants from the inclemency of the weather. The dead hedge, however, ought always to be at some distance from the living one, to allow the latter freely to put forth its branches. As already noticed, walls of different kinds are sometimes erected, whether Galloway dikes or of stone and lime, for the protection of young hedges; but there is a mode of making a hedge in the middle or in the face of a wall which deserves attention. It is executed in the following manner: The face of the bank is first cut down not quite perpendicular, but nearly so. A facing of stone is then begun at the bottom, and carried up regularly in the manner that stone walls are generally built. When it is raised about 18 inches or two feet high, according to circumstances, the space between the wall and the bank is filled up with good earth, well broke and mixed with lime or compost. The thorns are laid upon the earth in such a manner, as that at least four inches of the root and stem shall rest upon the earth, and the extremity of the top shall project beyond the wall. When the plants are thus regularly laid, the roots are covered with earth, and the wall continued upwards, a hole having been left which each plant peeps through. As the wall advances upwards, the space between it and the bank is gradually filled up: when completed, the wall is finished with a cope of sod or of stone and lime. When the plants begin to vegetate, the young shoots appear in the face of the wall, rising in a perpendicular direction.

676
Hedges in
the face of
a wall.

It is said, that Sir James Hall of Dunglass has adopted this mode of inclosing to a considerable extent in East Lothian; that the hedges have made great progress; and that they exhibit, upon the whole, an extremely handsome appearance.

Whatever may be thought of the propriety of planting trees in hedge-rows, there can be no doubt, that in certain situations the addition to a hedge or hedge and ditch of a belt of planting is a valuable acquisition to its owner and to the country. It is certain, however, as formerly stated, that in low rich soils where corn is chiefly cultivated, particularly when surrounded by hills, belts of planting are not only unnecessary, but even hurtful to the crop. But there are other situations in which they are of the highest value. The peninsula, which forms the county of Caithness, is said to be a proof of this. Its soil is of a good quality, but its value is greatly impaired by its being exposed to sea winds, whose severity checks all vegetation. Many tracts throughout the island are nearly in the same situation; and in all of them nothing more is wanted to improve the country than to intersect it in a judicious manner with hedges and belts of planting. Where belts of planting are meant to remain as an efficient fence, they ought to be of considerable breadth. In poor and cold situations the breadth ought to be such as to allow space for planting a great number of trees, which, from the shelter they mutually afford, may protect each other's growth against the severity of the climate. With the same view, in cold and exposed situations the young trees should be planted very thick; perhaps four or five times the number that can grow to a full size should be planted. This practice affords a choice of the most healthy plants to be left when the plantation is thinned. In belts of planting an error is sometimes committed of mingling firs, larches, and pines, with oaks, ashes, &c. with the intention that the evergreens should protect for a certain time the other trees, and thereafter be removed. The effect of which too frequently is, that when the evergreens are taken away, their growth is not only checked for several years; but being unable, after experiencing so much shelter, to resist the severity of the climate, they die altogether. This is the more likely to happen in consequence of the rapidity with which the firs and larches grow; for the oaks and other trees are drawn up along with them, and acquire, in some measure, the nature of hot-house plants, unfit to encounter the blasts of a northern climate: hence belts of planting should either be made altogether of evergreens or altogether of deciduous plants, such as oak, ash, &c. If the evergreens are at all introduced among these last, it ought to be sparingly, and at the outside of the belt, with the view to afford only a moderate degree of shelter.

Where fields are meant to remain constantly in pasturage, the belts may be made in a serpentine, and sometimes in a circular form, both for the sake of ornament, and to afford more complete shelter; but this cannot be done where the plough is meant to be introduced. Upon a north exposure, the belts should cross each other, at proper distances, to afford more complete shelter. Upon a south exposure, they ought to run from south to north, to afford a defence against the east and west winds, which are the strongest in this country.

677
Belts of
planting.

Fences.

Fences. country. Belts of planting require themselves to be fenced. A fence, which is merely intended to protect their growth, may consist of a mud wall; but if a permanent security is wanted, a hedge and ditch will be necessary.

In some situations, instead of the belt of planting, it is customary to plant only the corners of the fields; and this plan is advisable where the country requires but a moderate degree of shelter, added to that which it may derive from thriving hedges.

It has been proposed, that on all sheep farms of any extent, there ought to be one or more circular belts of planting, inclosing a space of about an acre or an acre and a half in the centre, with a serpentine road leading through the belt into this inclosure, the use of which is evident. In heavy falls of snow numerous flocks are sometimes buried, and the lives of the shepherds are not unfrequently lost in attempting to drive them to a place of safety. On such occasions, the inclosures we have now mentioned, would be of the utmost value. When a storm threatened, the sheep might be driven to these inclosures, where the snow could never be piled up by driving winds; and they might there be fed and remain with entire safety. If due care were taken to litter the place, a quantity of valuable dung might be collected, if the storm should remain for any length of time.

678
the reed
fence.

The reed fence has hitherto been only used in gardens. It consists of a kind of wall, formed by sewing with wrought yarn bundles of reeds, applied perpendicularly to a railing. This fence seems well adapted for giving temporary shelter to cattle; but as the materials of it cannot be everywhere found, its use must be very limited.

The entry to every inclosure ought to be secured by gate-posts; which, if circumstances will permit, ought

always to be of stone, and if possible, of hewn stone, as these, when properly constructed, will never fail. Trees are sometimes planted for this purpose, and when they have acquired a certain size, they are cut over about ten feet above the surface of the ground. These form the most durable of all gate-posts. They sometimes, however, misgive; in which case it is difficult to repair the defect. When gate-posts are made of dead timber they should be strong, and the wood well prepared by a coat of oil paint, as already mentioned.

Fences.
679
Gate-posts.

Of gates for inclosures there are different kinds. What is called the *swing-gate*, that crosses the whole breadth of a carriage road, and is of one piece, is by no means an advisable form. The length of its bars renders it expensive, and its great weight, with which it pulls against the gate-post, overstrains its own hinges, and is apt to bring down the side of the gate, unless it is erected in a very costly and solid manner. For this reason, a gate with two folding doors is preferable: it hangs upon the gate-post only with half its weight, in consequence of its being divided into two parts. Its hinges are not so liable to be hurt by straining, nor are its joints so liable to be broke. What is called the *ship-bar-gate*, consisting of three separate bars, which are taken out and put into the gate-posts every time the entry to the fields is opened and shut, is the best kind of gate, so far as cheapness and durability are concerned; but it does not admit of being locked, which renders it unfit for use near a public road, and the opening and shutting of it are also attended with a considerable degree of trouble.

680
Gates.

For an account of the latest improvements in agriculture, see the article AGRICULTURE, in the SUPPLEMENT.

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A G R

A G R

Agri-folium **AGRIFOLIUM**, or **AQUIFOLIUM**. See **ILEX**, **BOTANY Index**.
Agri-gen-tum **AGRIGAN**, or island of St Francis Xavier, in *Geography*, one of the Ladrone or Marianne islands. It is 50 miles in circumference, is very mountainous, and has a volcano in it; situated in N. Lat. 19. 4. E. Long. 146.

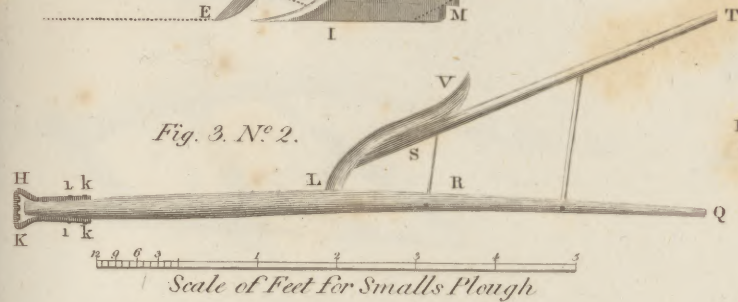
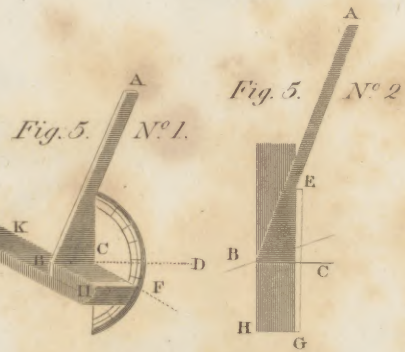
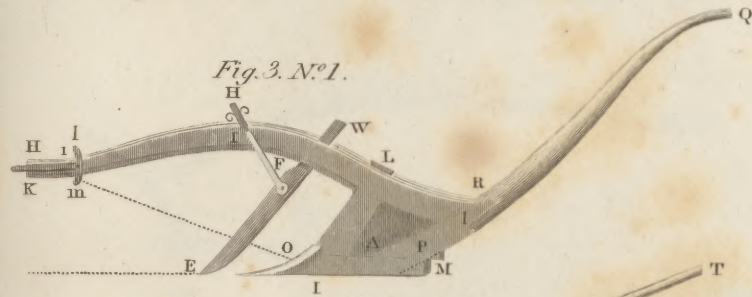
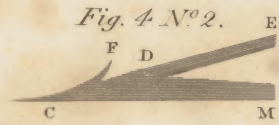
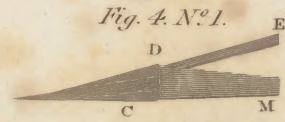
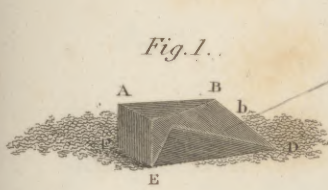
AGRIGENTUM, in *Ancient Geography*, a city of Sicily, part of the site of which is now occupied by a town called *Girgenti* from the old name. See **GIRGENTI**.

According to ancient authors, Dedalus, the most famous mechanician of fabulous antiquity, fled to this spot for protection against Minos, and built many wonderful edifices for Cocalus king of the island. Long after his flight, the people of Gela sent a colony hither 600 years before the birth of Christ; and from the name of a neighbouring stream called the new city *Acragas*, whence the Romans formed the word *Agrigentum*. These Greeks converted the ancient abode of the Siculi into a citadel to guard the magnificent city which they erected on the hillocks below.

An advantageous situation, a free government with all its happy effects, and an active commercial spirit, exalted their commonwealth to a degree of riches and power unknown to the other Greek settlements, Syracuse alone excepted. But the prosperity of Agrigentum appears to have been but of short duration, and tyranny soon destroyed its liberties.

Phalaris was the first who reduced it to slavery. His name is familiar to most readers on account of his cruelty, and the brazen bull in which he tortured his enemies. (See **PHALARIS**.)—Phalaris met with the common fate of tyrants, and after his death the Agrigentines enjoyed their liberty for 150 years; at the expiration of which term Thero usurped the sovereign authority. The moderation, justice, and valour of this prince preserved him from opposition while living, and have rescued his memory from the obloquy of posterity. He joined his son-in-law Gelo, king of Syracuse, in a war against the Carthaginians; in the course of

which victory attended all his steps, and Sicily saw herself for a time delivered from her African oppressors. Soon after his decease, his son Thrasylus was deprived of the diadem, and Agrigentum restored to her old democratical government. Ducetius next disturbed the general tranquillity. He was a chief of the mountaineers, descendants of the Siculi; and was an overmatch for the Agrigentines while they were unsupported by alliances, but sank under the weight of their union with the Syracusans. Some trifling altercations dissolved this union, and produced a war, in which the Agrigentines were worsted, and compelled to submit to humiliating terms of peace. Resentment led them to embrace with joy the proposals of the Athenians, then meditating an attack upon Syracuse. Their new friends soon made them feel that the sacrifice of liberty and fortune would be the price of their protection; and this consideration brought them speedily back to their old connections. But as if it had been decreed that all friendship should be fatal to their repose, the reconciliation and its effects drew upon them the anger of the Carthaginians. By this enemy their armies were routed, their city taken, their race almost extirpated, and scarce a vestige of magnificence was left. Agrigentum lay 50 years buried under its own ruins, when Timoleon, after triumphing over the Carthaginians, and restoring liberty to Sicily, collected the descendants of the Agrigentines, and sent them to re-establish the dwellings of their forefathers. Their exertions were rewarded with astonishing success; for Agrigentum rose from its ashes with such a renewal of vigour, that in a very short time we find it engaged in the bold scheme of seizing a lucky moment, when Agathocles and Carthage had reduced Syracuse to the lowest ebb, and arrogating to itself supremacy over all the Sicilian republics. Xenodocus was appointed the leader of this arduous enterprise; and had his latter operations been as fortunate as his first campaign, Agrigentum would have acquired such a preponderance of reputation and power, that the rival states would not have even dared to attack it. But a few



Scale of Feet for Smalls Plough

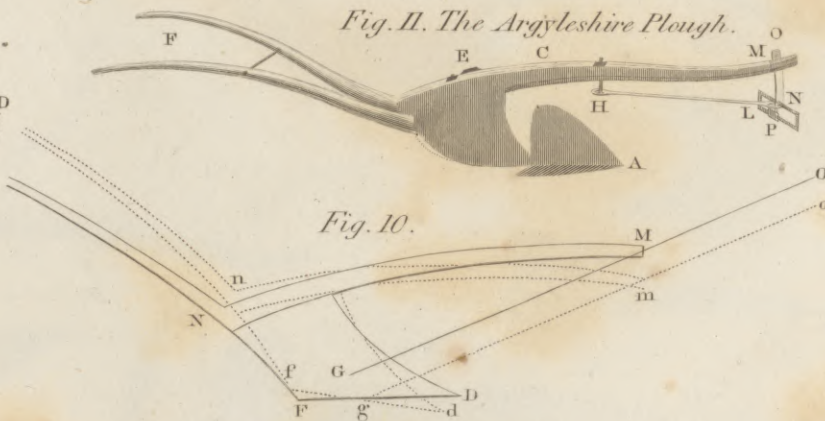
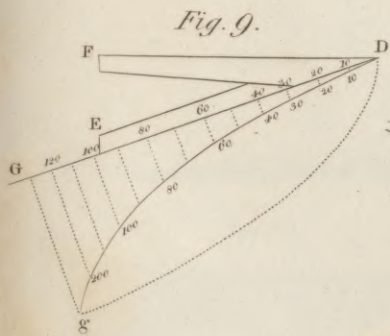
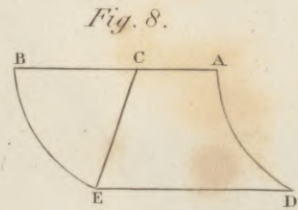
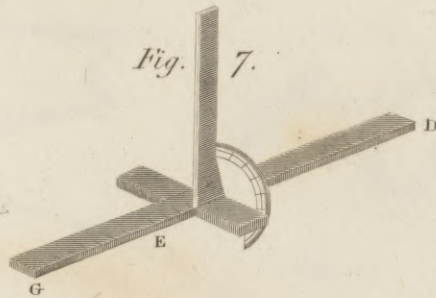


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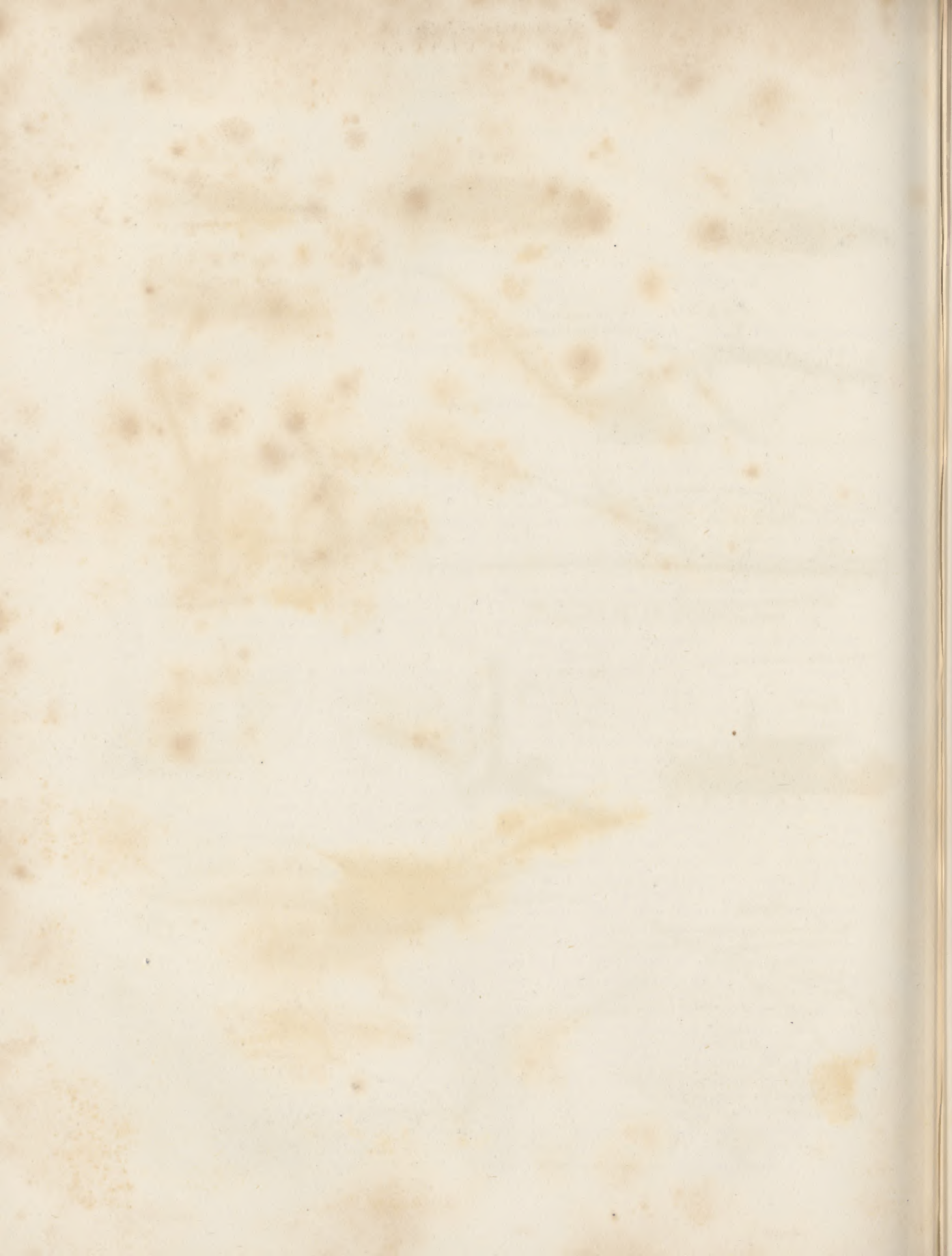


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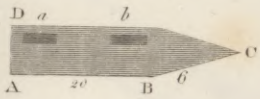


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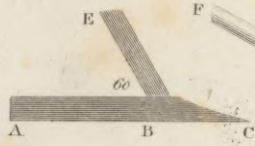


Fig. 5.



Fig. 4.



Fig. 3.

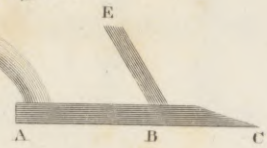


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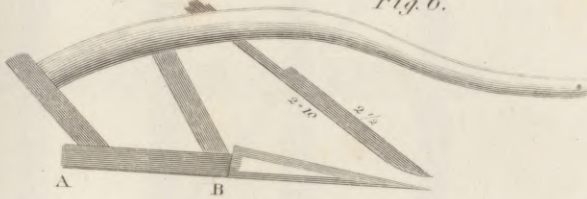


Fig. 7.



Fig. 8.

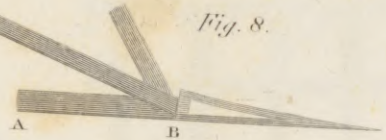


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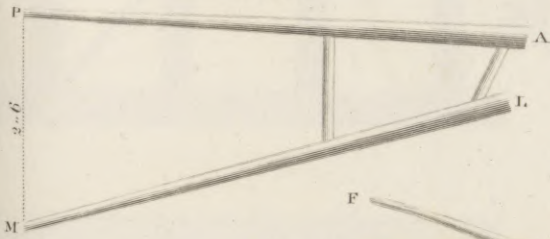


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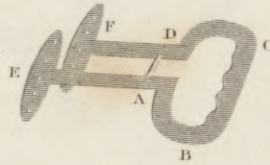


Fig. 10.

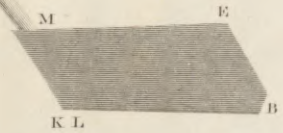


Fig. 11.

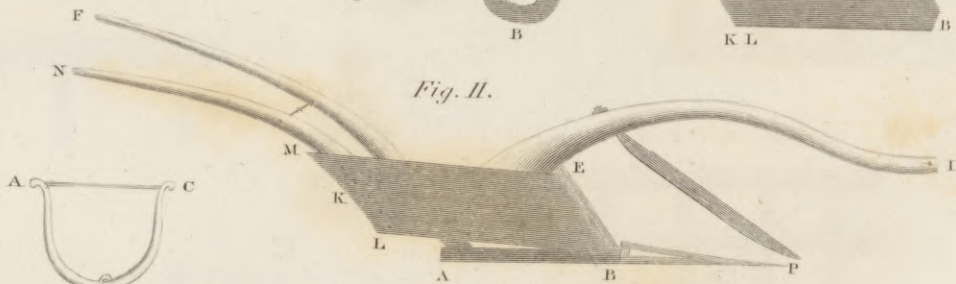


Fig. 12.

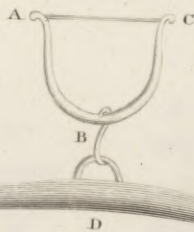


Fig. 15.



Fig. 16.

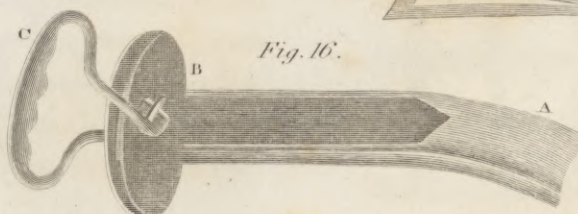


Fig. 14.





Fig. 1. Chain Plough

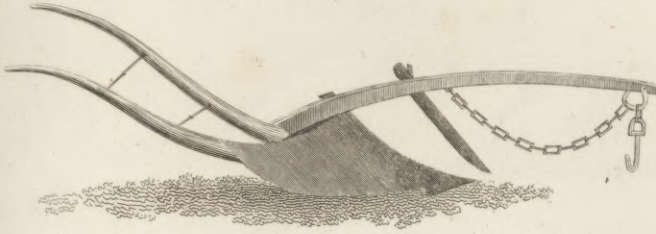


Fig. 2. Brake

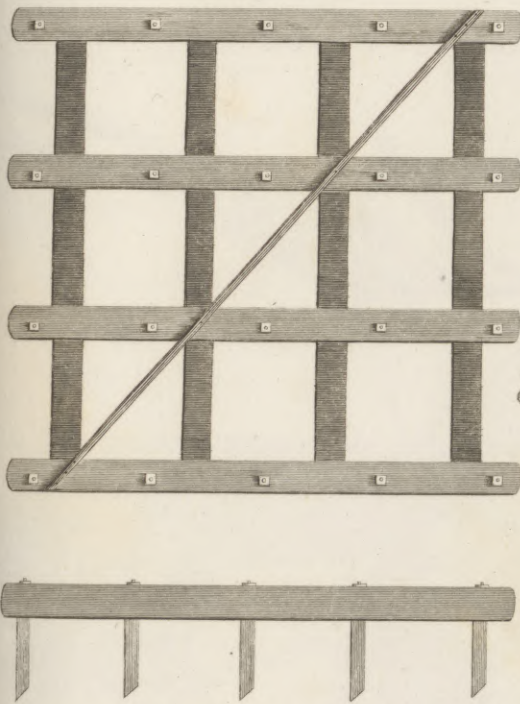


Fig. 3. first Harrow

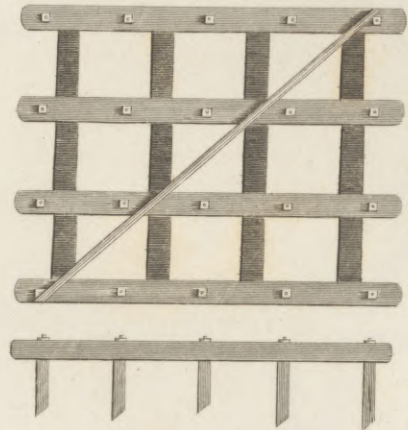


Fig. 8. Chain & Screw Harrow

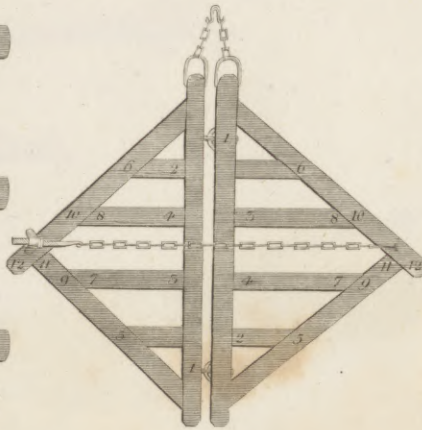


Fig. 4. second Harrow

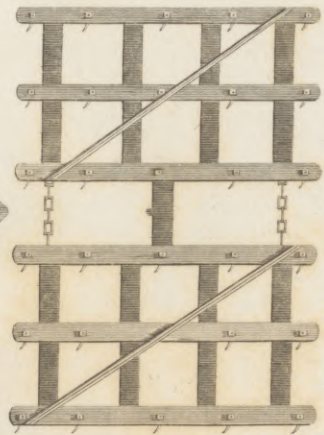


Fig. 5. third Harrow.

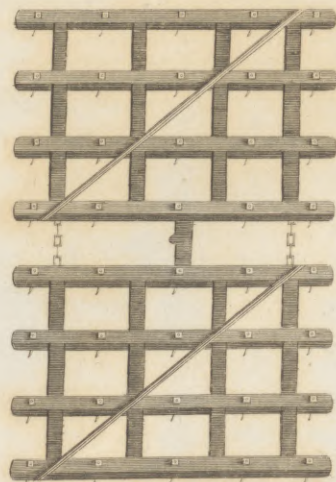


Fig. 6. Cleaning Harrow

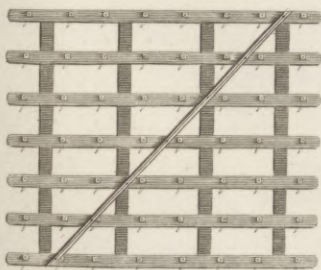


Fig. 7. Grass seed Harrow

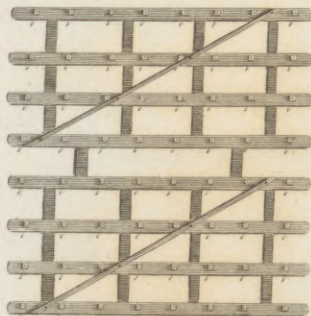


Fig. 1. Fear Coalterd Plough.

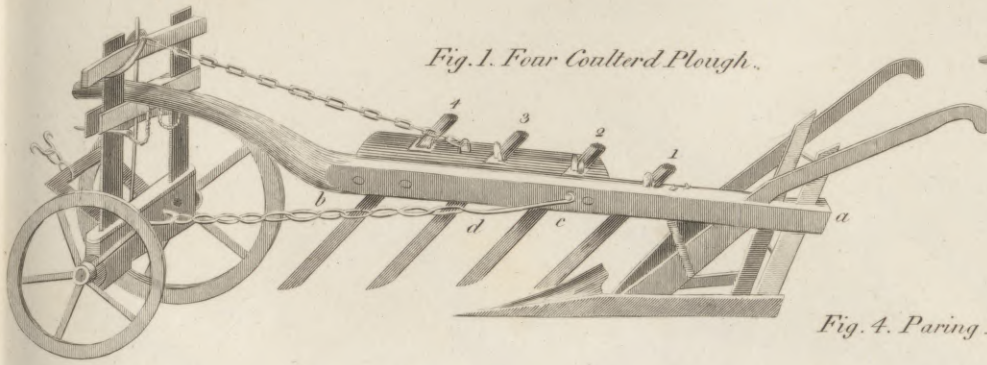


Fig. 2. Drill Rake.

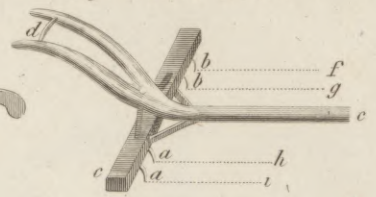


Fig. 4. Paring Plough.

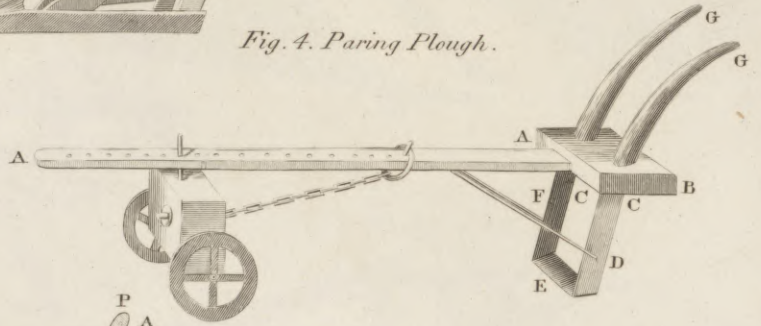


Fig. 3. Rotherham or Patent Plough.

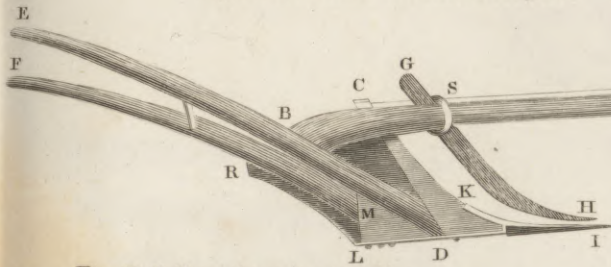


Fig. 5. Fallow cleansing Machine.

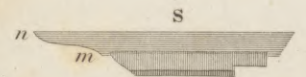
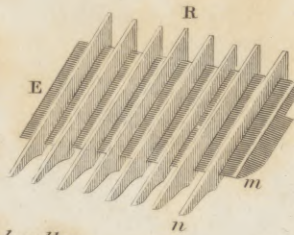
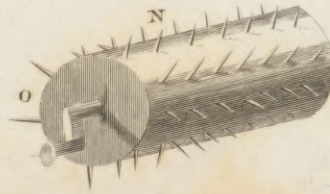
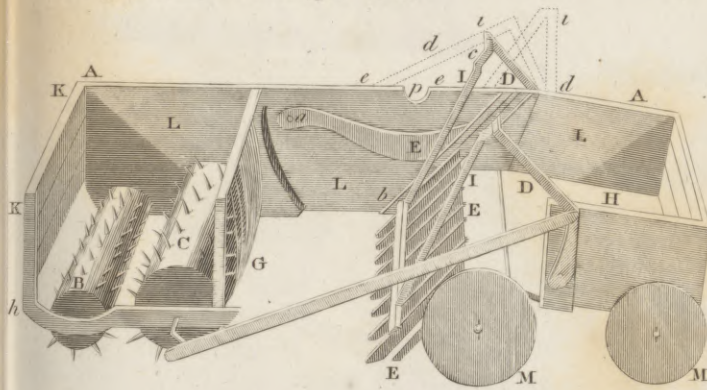


Fig. 6. Patent Sward cutter.

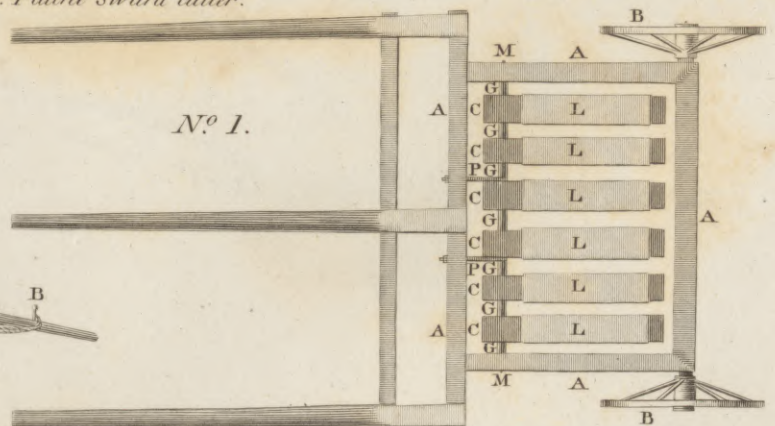
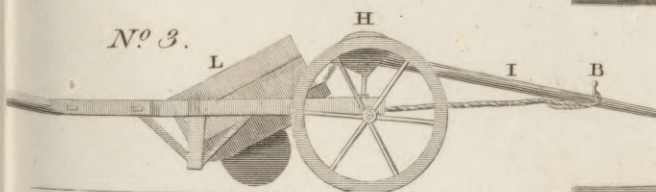
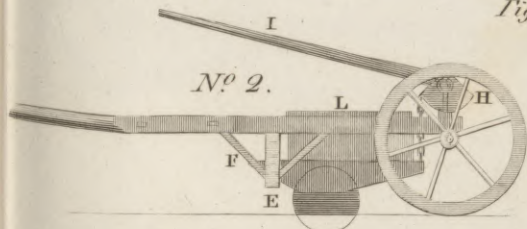


Fig. 1.

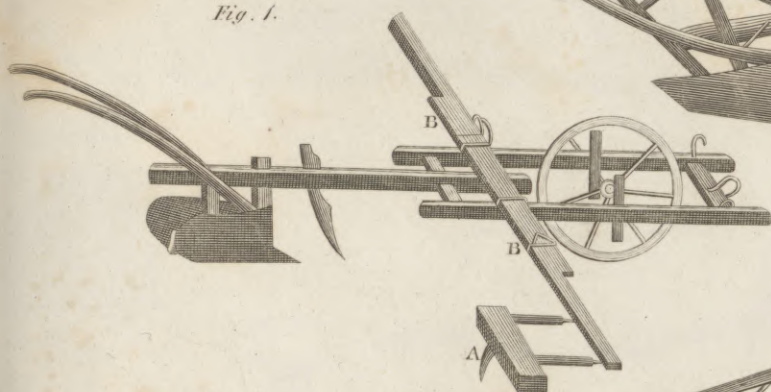


Fig. 2.

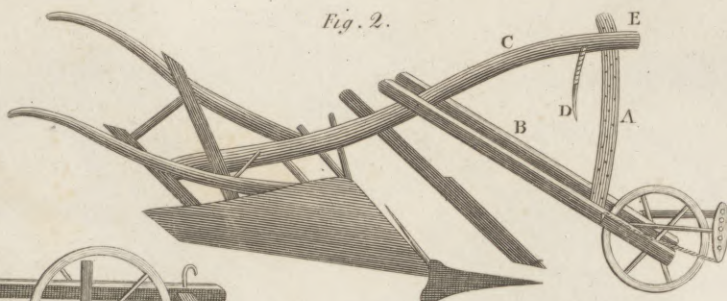


Fig. 3.

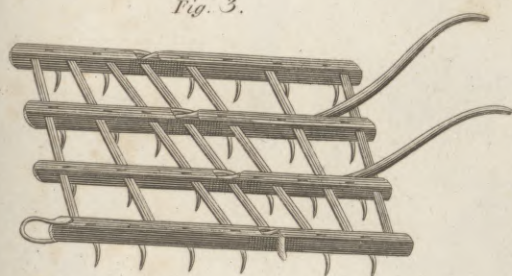


Fig. 4.

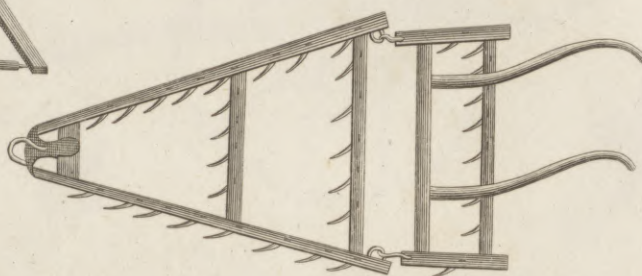


Fig. 5.

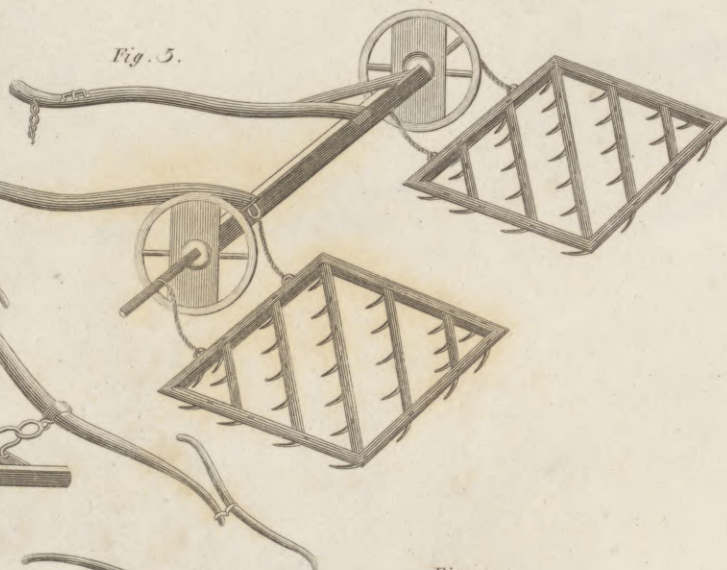


Fig. 6.

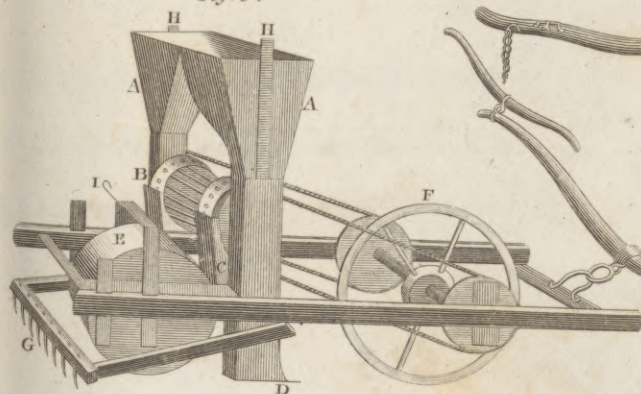
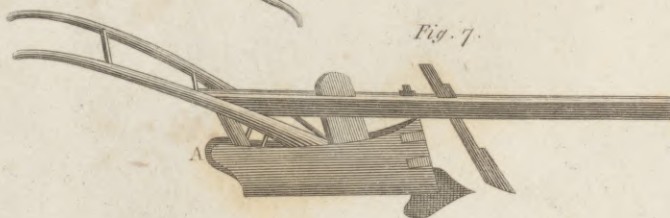


Fig. 7.



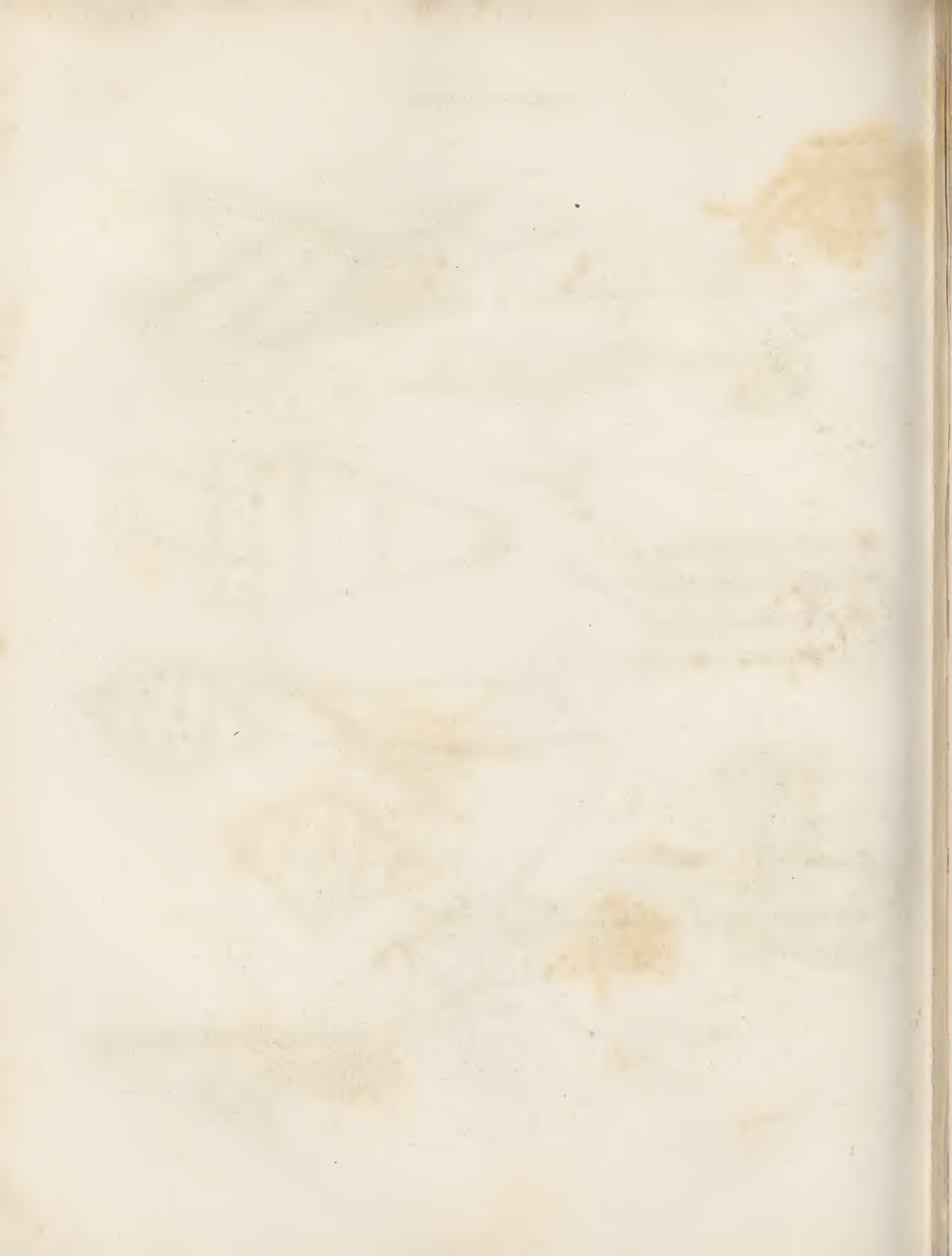


Fig. 1.
The Universal Sowing Machine.

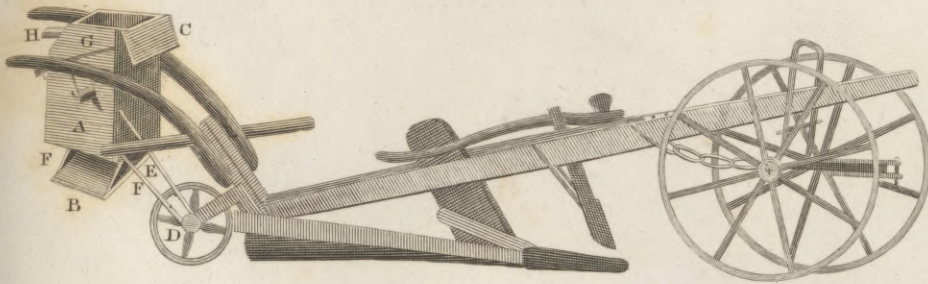


Fig. 8.



Fig. 3.

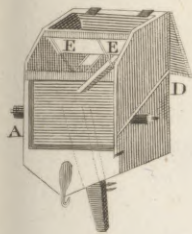


Fig. 2.

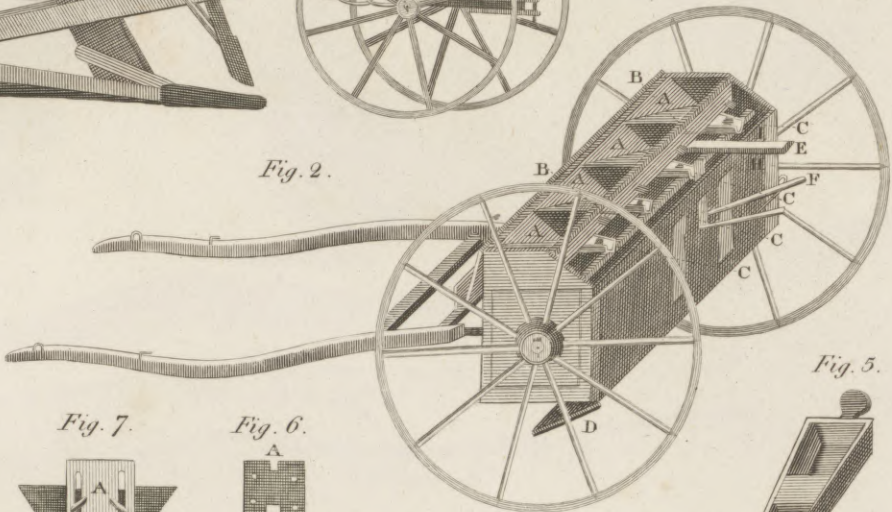


Fig. 5.



Fig. 10.

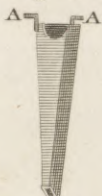


Fig. 7.



Fig. 6.

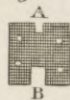


Fig. 4.

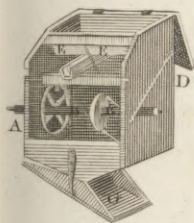
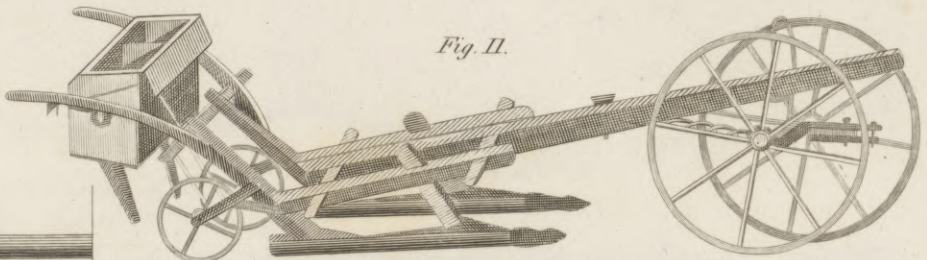


Fig. 11.



Cookes Drill Machine.

Fig. 9.

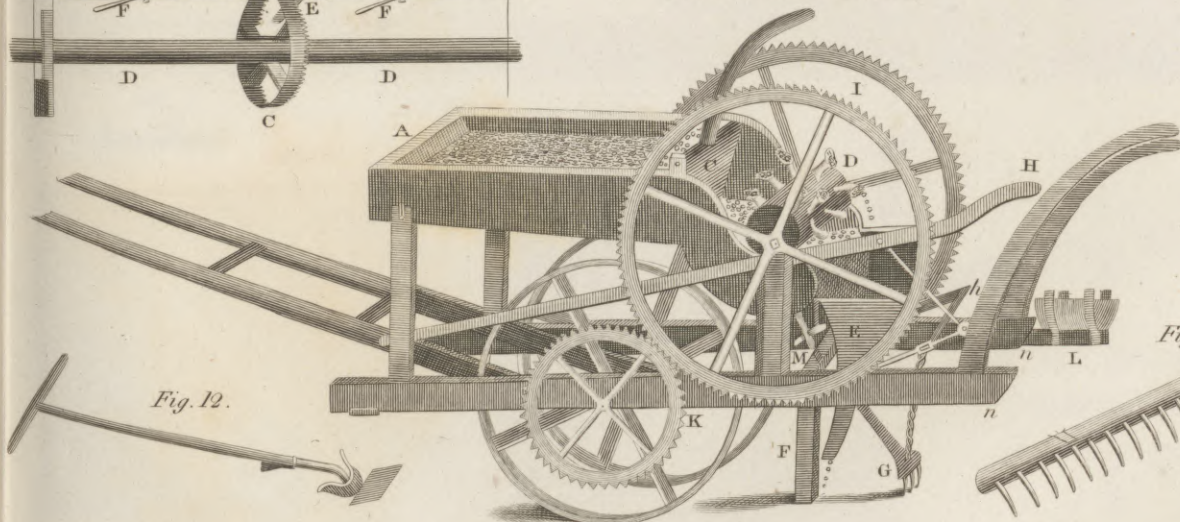
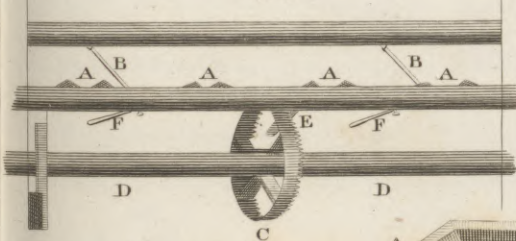
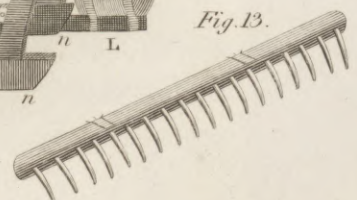
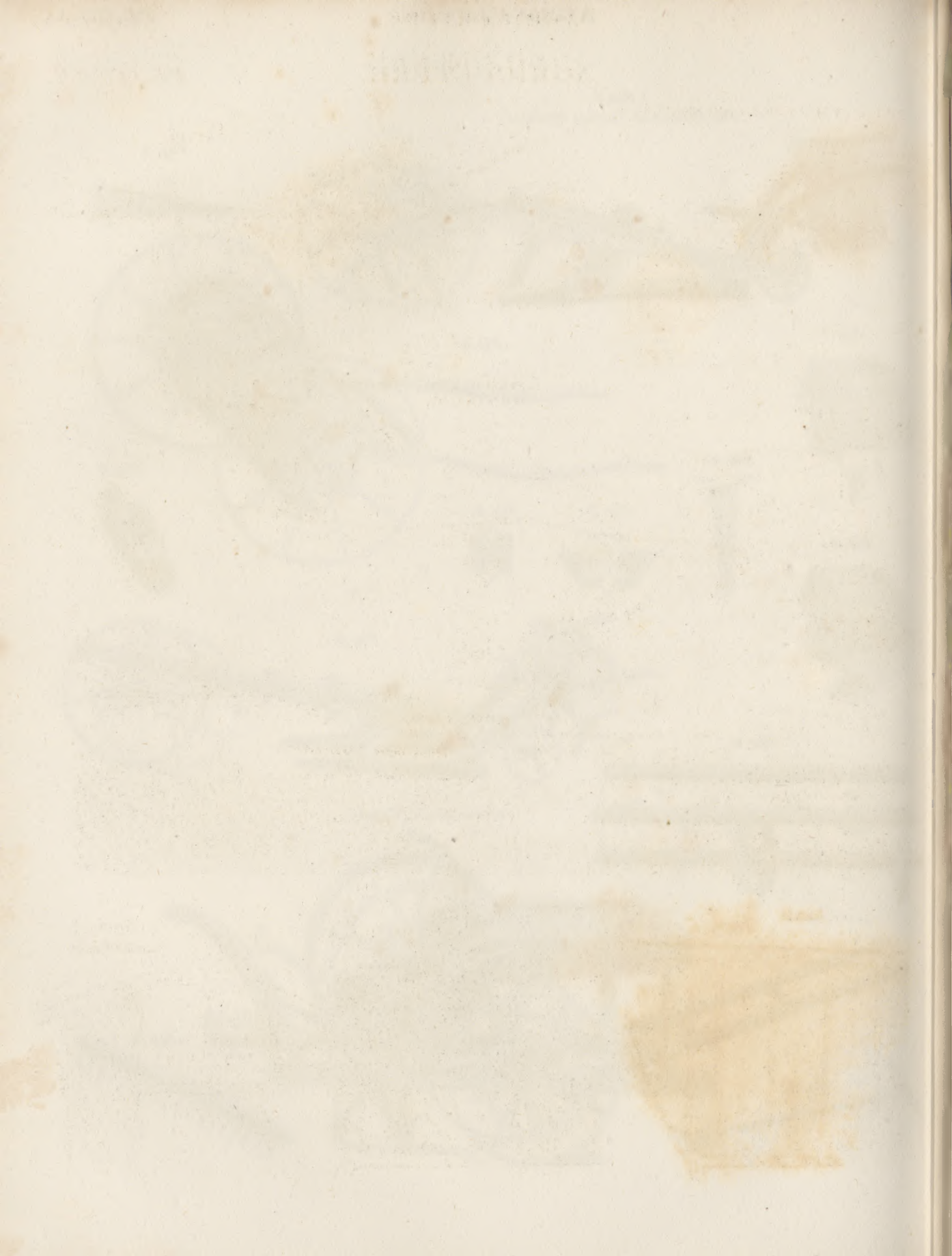


Fig. 12.

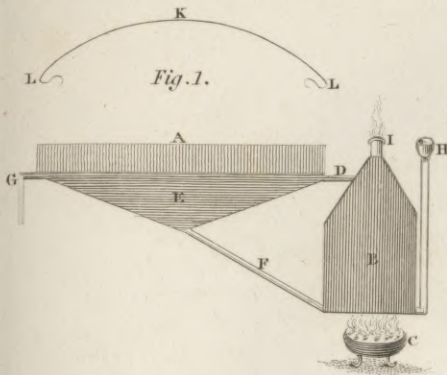


Fig. 13.





MR FORSYTH'S STEAM APPARATUS.



CULTIVATOR.

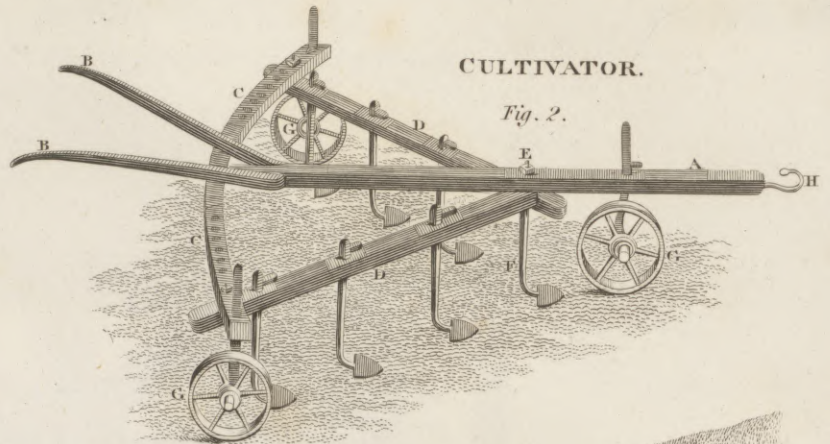
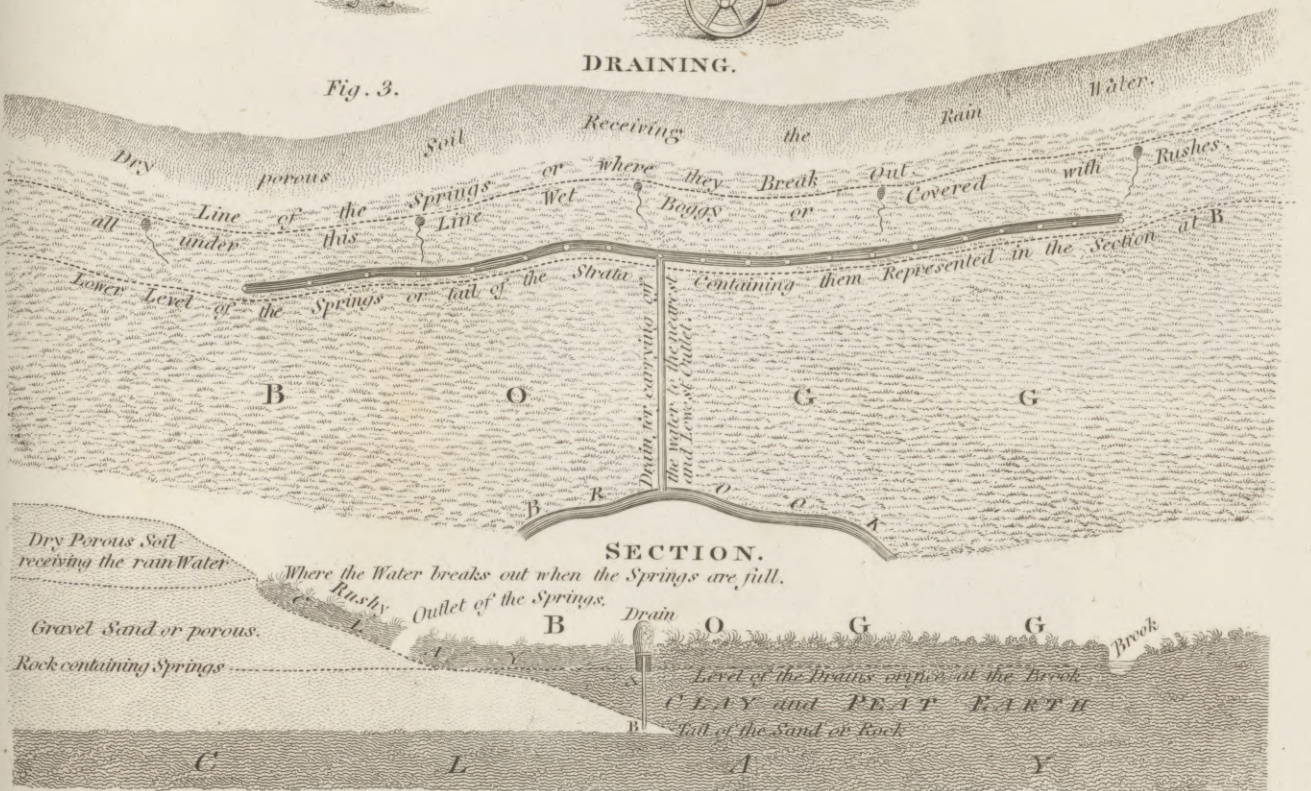


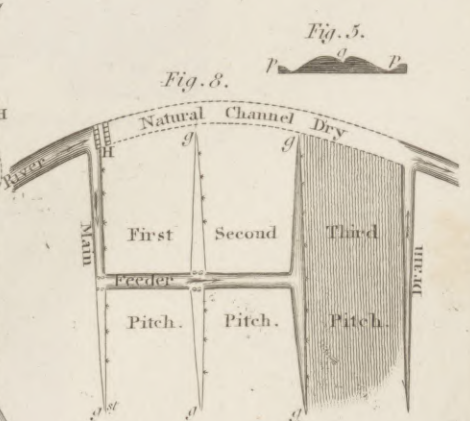
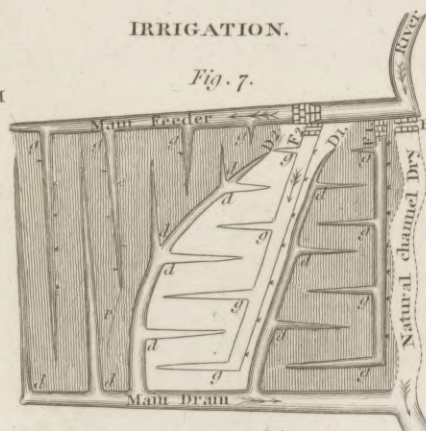
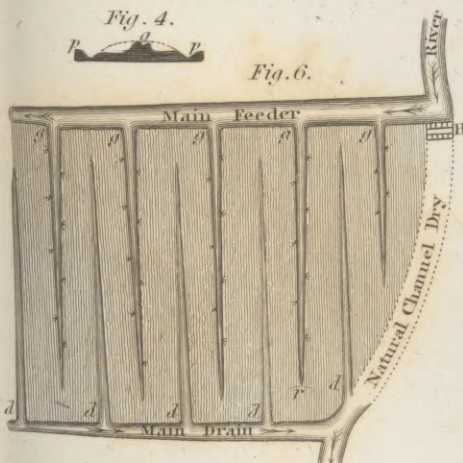
Fig. 3.

DRAINING.



SECTION.

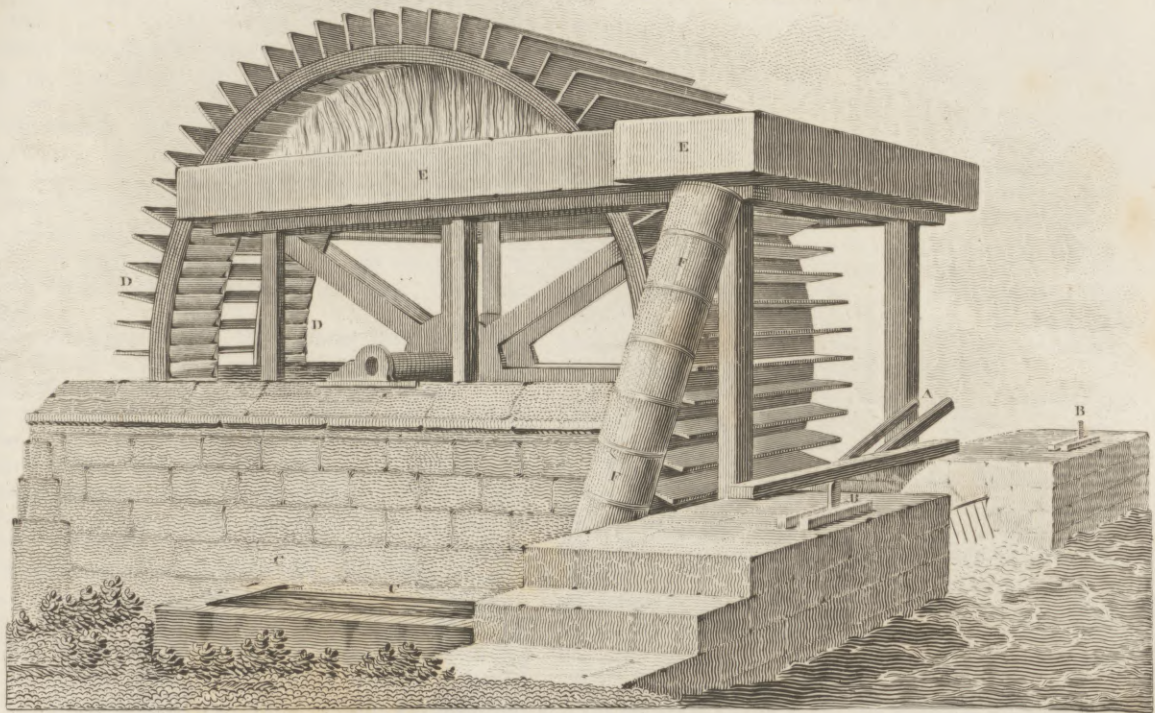
IRRIGATION.



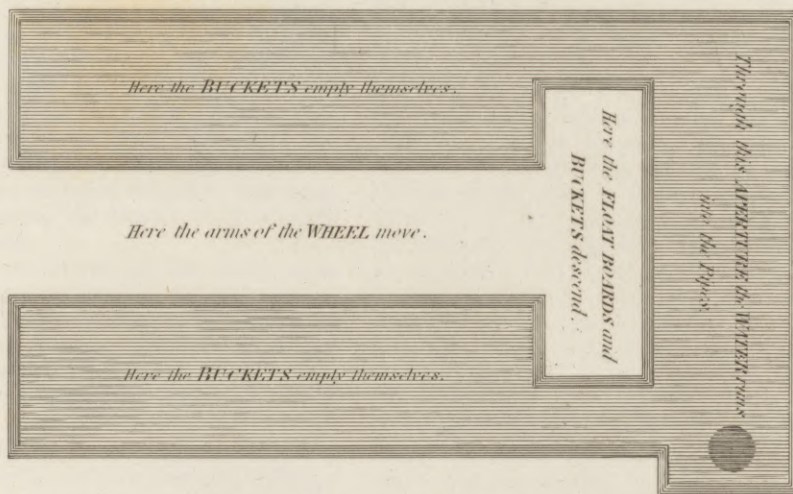
AGRICULTURE.

PLATE XIII.

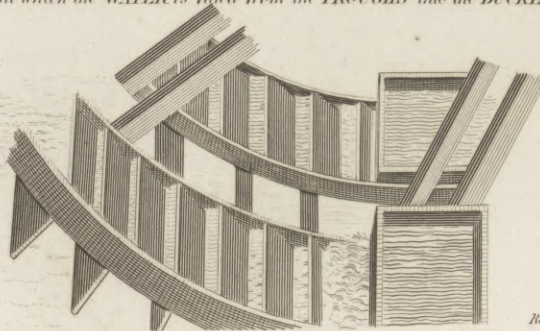
SKETCH of the WHEEL for raising WATER at BLAIR DRUMMOND.



Sketch of the CISTERN as seen from above.



SKETCH of the manner in which the WATER is filled from the TROUGHS into the BUCKETS.



Agrigentum. few brilliant exploits were succeeded by a severe overthrow; the Agrigentines lost courage, disagreed in council, and humbly sued for peace to Agathocles. This commonwealth afterwards took a strong part with Pyrrhus; and when he left Sicily to the mercy of her enemies, threw herself into the arms of Carthage. During the first Punic war Agrigentum was the head quarters of the Carthaginians, and was besieged by the Roman consuls, who after eight months blockade took it by storm. It nevertheless changed masters several times during the contest between these rival states, and in every instance suffered most cruel outrages. After this period very little mention of it occurs in history, nor do we know the precise time of the destruction of the old city and the building of the new one. See GIRGENTI.

The principal part of the ancient city lay in the vale; the present town, called *Girgenti*, occupies the mountain on which the citadel of Cocalus stood.

It was difficult to be more judicious and fortunate in the choice of situation for a large city. The inhabitants were here provided with every requisite for defence, pleasure, and comfort of life; a natural wall, formed by abrupt rocks, presented a strong barrier against assailants; pleasant hills sheltered them on three sides without impeding the circulation of air; before them a broad plain, watered by the Acragas, gave admittance to the sea breeze, and to a noble prospect of that awful element; the port or emporium lay in view at the mouth of the river, and probably the road across the flat was lined with gay and populous suburbs.

The hospitality and parade for which the Agrigentines are celebrated in history were supported by an extensive commerce; by means of which, the commonwealth was able to resist many shocks of adversity, and always to rise again with fresh splendour. It was, however, crushed by the general fall of Grecian liberty; the feeble remnants of its population, which had survived so many calamities, were at length driven out of its walls by the Saracens, and obliged to lock themselves up for safety among the bleak and inaccessible rocks of the present city.

At the north-east angle of the ancient limits, upon some foundations of large regular stones, a church has been erected; a road appears hewn in the solid rock for the convenience of the votaries who visited this temple in ancient days. It was then dedicated to Ceres and her daughter Proserpine, the peculiar patronesses of Sicily.

At the south-east corner, where the ground, rising gradually, ends in a bold eminence, which is crowned with majestic columns, are the ruins of a temple said to have been consecrated to Juno. To the west of this stands the building commonly called the temple of Concord; the stone of which, and the other buildings, is the same as that of the neighbouring mountains and cliffs, a conglutination of sea sand and shells, full of perforations, of a hard and durable texture, and a deep reddish brown colour. This Doric temple has all its columns, entablature, pediments, and walls entire; only part of the roof is wanting. It owes its preservation to the piety of some Christians, who have covered half the nave, and converted it into a church

consecrated under the invocation of St Gregory bishop of Girgenti.

Proceeding in the same direction you walk between rows of sepulchres cut in the rock wherever it admitted of being excavated by the hand of men, or was so already by that of nature. Some masses of it are hewn into the shape of coffins; others drilled full of small square holes, employed in a different mode of interment, and serving as receptacles of urns. One ponderous piece of the rock lies in an extraordinary position; by the failure of its foundation, or the shock of an earthquake, it has been loosened from the general quarry, and rolled down the declivity, where it now remains supine with the cavities turned upwards. Only a single column marks the confused heap of moss-grown ruins belonging to the temple of Hercules. It stood on a projecting rock above a chasm in the ridge, which was cut through for a passage to the emporium.

In the same tract, over some hills, is situated the building usually called the tomb of Thero. It is surrounded by aged olive-trees, which cast a wild irregular shade over the ruin. The edifice inclines to the pyramidal shape, and consists at present of a triple plinth, and a base supporting a square pedestal; upon this plain solid foundation is raised a second order, having a window in each front, and at each angle two Ionic pilasters crowned with an entablature of the Doric order. Its inside is divided into a vault, a ground room, and one in the Ionic story, communicating with each other by means of a small internal staircase.

In the plain are seen the fragments of the temple of Esculapius; part of two columns and two pilasters, with an intermediate wall, support the end of a farmhouse, and were probably the front of the cella. Pursuing the track of the walls towards the west, you arrive at a spot which is covered with the gigantic remains of the temple of the Olympian Jupiter, minutely described by Diodorus Siculus. It may literally be said that it has not one stone left upon another; and it is barely possible with the help of much conjecture, to discover the traces of its plan and dimensions. Diodorus calls it the largest temple in the whole island: but adds, that the calamities of war caused the work to be abandoned before the roof could be put on; and that the Agrigentines were ever after reduced to such a state of poverty and dependence, that they never had it in their power to finish this superb monument of the taste and opulence of their ancestors. The length of this temple was 370 Greek feet, its breadth 60, and its height 220, exclusive of the foundations or basement story: the extent and solidity of its vaults and underworks were wonderful; its spacious porticoes and exquisite sculpture were suited to the grandeur of the whole. It was not built in the usual style of Sicilian temples, with a cella of massive walls and a peristyle, but was designed in a mixt taste with half columns let into the walls on the outside, the inside exhibiting a plain surface.

The next ruin belongs to the temple of Castor and Pollux: vegetation has covered the lower parts of the building, and only a few fragments of columns appear between the vines. This was the point of the hill where the wall stooped on the brink of a large fish-pond spoken of by Diodorus: it was cut in the solid rock

Agrigen-
tum
||
Agrippa.

30 feet deep, the water was conveyed to it from the hills. In it was bred a great quantity of fish for the use of public entertainments; swans and various other kinds of wild fowl swam along its surface, for the amusement of the citizens; and the great depth of water prevented an enemy from surprising the town on that side. It is now dry and used as a garden. On the opposite bank, are two tapering columns without their capitals, most happily placed in a tuft of carob trees. Monte Toro, where Hanno encamped with the Carthaginian army, before the Roman consuls drew him into an engagement that ruined his defensive plan, is a noble back-ground to this picturesque group of objects.—The whole space comprehended within the walls of the ancient city abounds with traces of antiquity, foundations, brick arches, and little channels for the conveyance of water; but in no part are any ruins that can be presumed to have belonged to places of public entertainment. This is the more extraordinary, as the Agrigentines were a sensual people, fond of shows and dramatic performances, and the Romans never dwelt in any place long without introducing their savage games. Theatres and amphitheatres seem better calculated than most buildings to resist the outrages of time; and it is surprising that not even the vestiges of their form should remain on the ground.

AGRIMONIA, AGRIMONY. See BOTANY *Index*.

Hemp AGRIMONY. See EUPATORIUM, BOTANY *Index*.

Water Hemp AGRIMONY. See BIDENS, BOTANY *Index*.

AGRIONIA, in Grecian antiquity, festivals annually celebrated by the Bœotians in honour of Bacchus. At these festivals the women pretended to search after Bacchus as a fugitive; and, after some time gave over their inquiry, saying that he had fled to the Muses, and was concealed among them.

AGRIOPHAGI, in antiquity, a name given to those who fed on wild beasts. The word is Greek, compounded of *αγριος*, "wild," "savage," and *φαγω*, "I eat." The name is given, by ancient writers, to certain people, real or fabulous, said to have fed altogether on lions or panthers. Pliny and Solinus speak of *Agriophagi* in Ethiopia, and Ptolemy of others in India on this side the Ganges.

AGRIPPA, CORNELIUS, born at Cologne in 1486, a man of considerable learning, and by common report a great magician; for the monks at that time suspected every thing of heresy or sorcery which they did not understand. He composed his *Treatise of the Excellence of Women* to insinuate himself into the favour of Margaret of Austria, governess of the Low-Countries. He accepted of the charge of historiographer to the emperor, which that princess gave him. The treatise of the *Vanity of the Sciences*, which he published in 1530, enraged his enemies extremely; as did that of *Occult Philosophy*, which he printed soon after at Antwerp. He was imprisoned in France for something he had written against Francis I.'s mother; but was enlarged, and went to Grenoble, where he died in 1534. His works are printed in two volumes octavo.

AGRIPPA, Herod, the son of Aristobulus and Mariamne, and grandson to Herod the Great, was born in the year of the world 3997, three years before the birth of our Saviour, and seven years before the vulgar

era. After the death of Aristobulus his father, Josephus informs us, that Herod his grandfather took care of his education, and sent him to Rome to make his court to Tiberius. The emperor conceived a great affection for Agrippa, and placed him near his son Drusus. Agrippa very soon won the graces of Drusus, and of the empress Antonia. But Drusus dying suddenly, all those who had been much about him were commanded by Tiberius to withdraw from Rome, lest the sight and presence of them should renew his affliction. Agrippa, who had indulged his inclination to liberality, was obliged to leave Rome overwhelmed with debts, and in a very poor condition. He did not think it fit to go to Jerusalem, because he was not able to make a figure there suitable to his birth. He retired therefore to the castle of Massada, where he lived, rather like a private person than a prince. Herod the tetrarch, his uncle, who had married Herodias his sister, assisted him for some time with great generosity. He made him principal magistrate of Tiberias, and presented him with a large sum of money; but all this was not sufficient to answer the excessive expences and profusion of Agrippa; so that Herod growing weary of assisting him, and reproaching him with his bad economy, Agrippa took a resolution to quit Judea, and return to Rome. Upon his arrival, he was received into the good graces of Tiberius, and commanded to attend Tiberius Nero the son of Drusus. Agrippa, however, having more inclination for Caius the son of Germanicus, and grandson of Antonia, chose rather to attach himself to him; as if he had some prophetic views of the future elevation of Caius, who at that time was beloved by all the world. The great assiduity and agreeable behaviour of Agrippa so far engaged this prince, that he kept him continually about him.

Agrippa being one day overheard by Eutyches, a slave whom he had made free, to express his wishes for Tiberius's death and the advancement of Caius, the slave betrayed him to the emperor: whereupon Agrippa was loaded with fetters, and committed to the custody of an officer. Tiberius soon after dying, and Caius Caligula succeeding him, the new emperor heaped many favours and much wealth upon Agrippa; changed his iron fetters into a chain of gold; set a royal diadem upon his head; and gave him the tetrarchy which Philip, the son of Herod the Great had been possessed of, that is, Batanæa and Trachonitis. To this he added that of Lysanias; and Agrippa returned very soon into Judea to take possession of his new kingdom.

Caius being soon after killed, Agrippa, who was then at Rome, contributed much by his advice to maintain Claudius in possession of the imperial dignity, to which he had been advanced by the army. But in this affair Agrippa acted a part wherein he showed more cunning and address than sincerity and honesty; for while he made a show of being in the interest of the senate, he secretly advised Claudius to be resolute, and not to abandon his good fortune. The emperor, as an acknowledgment for his kind offices, gave him all Judea and the kingdom of Chalcis, which had been possessed by Herod his brother. Thus Agrippa became of a sudden one of the greatest princes of the east; and was possessed of as much, if not more territories

^{Agrippa, Agrippina} ritories than had been held by Herod the Great his grandfather. He returned to Judea, and governed it to the great satisfaction of the Jews. But the desire of pleasing them, and a mistaken zeal for their religion, induced him to commit an unjust action, the memory of which is preserved in Scripture, Acts xii. 1, 2, &c.; for about the feast of the passover, in the year of Jesus Christ 44, St James major, the son of Zebedee and brother of St John the Evangelist, was seized by his order and put to death. He proceeded also to lay hands on St Peter, and imprisoned him, waiting till the festival was over, that he might then have him executed. But God having miraculously delivered St Peter from the place of his confinement, the designs of Agrippa were frustrated. After the passover, this prince went from Jerusalem to Cæsarea, and there had games performed in honour of Claudius. Here the inhabitants of Tyre and Sidon waited on him to sue for peace. Agrippa being come early in the morning to the theatre, with a design to give them audience, seated himself on his throne dressed in a robe of silver-tissue, worked in the most admirable manner. The rising sun darted on it with its rays, and gave it such a lustre as the eyes of the spectators could not endure. When therefore the king spoke to the Tyrians and Sidonians, the parasites around him began to say, that it was the voice of a god, and not that of a man. Instead of rejecting these impious flatteries, Agrippa received them with an air of complacency; but at the same time observed an owl above him on a cord. He had seen the same bird before when he was in bonds by order of Tiberius: and it was then told him, that he should be soon set at liberty; but that whenever he saw the same thing a second time, he should not live above five days afterwards. He was therefore extremely terrified; and he died at the end of five days, racked with tormenting pains in his bowels, and devoured with worms. Such was the death of Herod Agrippa, after a reign of seven years, in the year of Christ 44.

AGRIPPA II. son of the preceding Herod, was made king of Chalcis; but three or four years after, he was deprived of that kingdom by Claudius, who gave him in the place of it other provinces. In the war Vespasian carried on against the Jews, Herod sent him a succour of 2000 men; by which it appears that though a Jew by religion, he was yet entirely devoted to the Romans, whose assistance indeed he wanted to secure the peace of his own kingdom. He lived to the third year of Trajan, and died at Rome A. C. 100. He was the seventh and last king of the family of Herod the Great. It was before him and Berenice his sister that St Paul pleaded his cause at Cæsarea.

AGRIPPA, *Marcus Vispanius*, son-in-law to Augustus, of mean birth, but one of the most considerable generals among the Romans. Augustus's victory over Pompey and Mark Antony was owing to his counsel. He adorned the city with the Pantheon, baths, aqueducts, &c.

AGRIPPINA, daughter of Germanicus, sister of Caligula, and mother of Nero; a woman of wit, but excessively lewd. She was thrice married, the last time to Claudius her own uncle, whom she poisoned to make way for Nero her son. Nero afterwards caused her to be murdered in her chamber, when she bid the execu-

tioner stab her first in the belly that had brought forth such a monster.

AGRIPPINA COLONIA UBIORUM, in *Ancient Geography*, now *Cologne*: so called from Agrippina, the daughter of Germanicus, and mother of Nero, who had a colony sent thither at her request by the emperor Claudius, to honour the place of her birth. See COLOGNE.

AGRIPPINIANS, in *Church History*, the followers of Agrippinus bishop of Carthage, in the third century, who first introduced and defended the practice of re-baptization.

AGROM, a disease frequent in the East Indies, in which the tongue is parched, chaps, and is sometimes covered with white spots. The Indians attribute this disease to extreme heat of the stomach.

AGROSTEMMA, WILD LYCHNIS, or CAMPION, in *Botany*. See BOTANY *Index*.

AGRÖSTIS, BENT-GRASS, in *Botany*. See BOTANY *Index*.

AGROSTOGRAPHIA, signifies the history or description of grasses.

AGROUND, the situation of a ship whose bottom, or any part of it, hangs, or rests upon the ground, so as to render her immoveable, till a greater quantity of water floats her off, or till she is drawn out into the stream by the application of mechanical powers.

AGRYPNIA, among *Physicians*, implies an inaptitude to sleep; a troublesome symptom of feverish and other disorders.

AGRYPNIA, in the *Greek Church*, implies the vigil of any of the greater festivals.

AGUE, a general name for all periodical fevers, which, according to the different times of the returns of the feverish paroxysm, are denominated tertian, quartan, and quotidian. See MEDICINE *Index*.

AGUE-Cake, the popular name for a hard tumour on the left side of the belly, lower than the false ribs, said to be the effect of intermittent fevers.

AGUE-Tree, a name given to the sassafras, on account of its febrifuge qualities.

AGUEPERSE, a town of France, situated in the Lyonnais, in the department of Puy-de-Dome, about 15 miles north of Clermont.

AGUESSEAU, H. F. an eminent French lawyer. See SUPPLEMENT.

AGUILLANEUF, or AUGILLANEUF, a form of rejoicing used among the ancient Franks on the first day of the year. The word is compounded of the French *A*, "to," *gui*, "misleto," and *l'an neuf*, "the new year." Its origin is traced from a druid ceremony: the priests used to go yearly in December, which with them was reputed a sacred month, to gather misleto of the oak in great solemnity. The prophets marched in the front, singing hymns in honour of their deities; after them came a herald with a caduceus in his hand; these were followed by three druids abreast, bearing the things necessary for sacrifice; last of all came the chief or arch druid, accompanied with the train of people. The chief druid climbing the oak, cut off the misleto with a golden sickle, and the other druids received it in a white cloth; on the first day of the year it was distributed among the people, after having blessed and consecrated it by crying *A gui l'an neuf*, to proclaim

Agrippina
Aguilla-
neuf.

Aguilla-
neuf
||
Aguirum.

proclaim the new year. This cry is still continued in Picardy, with the addition of *Plantex, Plantex*, to wish a plentiful year. In Burgundy and some other parts, the children use the same word to beg a new-year's gift. In latter times the name *Aguillaneuf* was also given to a sort of begging, practised in some dioceses, for church tapers, on new year's day, by a troop of young people of both sexes, having a chief, &c. It was attended with various ridiculous ceremonies, as dancing in the church, &c. which occasioned the synods to suppress it.

AGUILAR, a town of Spain, in the province of Navarre, about 24 miles west from Estella.

AGUILAR del Campo, a town of Old Castile, with the title of marquise, about 15 leagues north of the city of Burgos.

AGUILLON, or **AGUILLONIUS**, FRANCIS, a Jesuit, born at Brussels: he was rector of the Jesuits college at Antwerp, and eminent for his skill in mathematics. He was the first who introduced that science among the Jesuits in the Low Countries: he wrote a book of Optics, and was employed in finishing his Catoptrics and Dioptrics, when he died in 1617.

AGUIRRA, JOSEPH SÆNZ DE, a Benedictine, and one of the most learned men of the 17th century, was born March 24. 1630. He was censor and secretary of the supreme council of the inquisition in Spain, and interpreter of the Scriptures in the university of Salamanca. He printed three volumes in folio upon Philosophy, a commentary upon Aristotle's ten books of Ethics, and other pieces. He died at Rome in 1699.

AGUL, in *Botany*, a synonyme of the *hedysarum*. See *HEDYSARUM*, *BOTANY Index*.

AGUR. The xxxth chapter of the Proverbs begins with this title: "The words of Agur, the son of Jakeh;" which, according to the signification of the original terms, may be translated, as the Vulgate has it, *Verba congregantis, filii vomentis*; which translation Le Clerc condemns, supposing these to be proper names which ought not to be translated. These words are rendered by Louis de Dieu, "the words of him who has recollected himself, the son of obedience." The generality of the fathers and commentators will have it, that Solomon describes himself under the name Agur the son of Jakeh; others conjecture that Agur, as well as Lemuel (in chap. xxxi. 1.) were wise men who lived in the time of Solomon, and were his interlocutors in the book of Proverbs; an opinion which F. Calmet thinks is without the least show of probability, this book being nothing like a dialogue. This last expositor thinks it probable, that Agur was an inspired author different from Solomon, whose sentences it was thought fit to join with those of this prince, because of the conformity of their matter.

AGURAH, in Jewish antiquity, the name of a silver coin, otherwise called *gerah* and *keshta*.

AGURIUM, or **AGYRIUM**, in *Ancient Geography*, a town of Sicily in the Val di Demona, near the river Semetus. The people were called *Populus Agyrinensis* by Cicero; *Agyrinus* by Pliny. It was the birth-place of Diodorus Siculus, as he himself testifies; but he calls it *Argyrium*, as it is now called *S. Philippo d'Argyrone*, which modern name seems to confirm that *Argyrium* is the true reading.

AGUSADURA, in ancient customs, a fee due from vassals to their lord for the sharpening their ploughing tackle. Anciently the tenants in some manors were not allowed to have their rural implements sharpened by any but whom the lord appointed; for which an acknowledgment was to be paid, called *agu sadura*, in some places *agusage*: which some take to be the same with what was otherwise called *reillage*, from the ancient French *reille*, a ploughshare.

AGUSTINA, a new earth; which, as the word signifies, is tasteless, insoluble in water, and when pure resembles alumina. It was discovered in the year 1800 by Trommsdorff in the Saxon beryl. But as his experiments have not been repeated, the existence of this earth rests solely on his authority.

AGUTI, in *Zoology*, the trivial name of a species of the mouse, belonging to the mammalia glires of Linnæus.

AGYEI, in antiquity, a kind of obelisks, sacred to Apollo, erected in the vestibules of houses, by way of security.

AGYNEIA, in *Botany*. See *BOTANY Index*.

AGYNIANI, in church history, a sect who condemned all use of flesh, and marriage, as not instituted by God, but introduced at the instigation of the devil. The word is compounded of the privative *a*, and *γυν*, woman. They are sometimes also called *Agynenses*, and *Agynii*: and are said to have appeared about the year 694. It is no wonder they were of no long continuance. Their tenets coincide in a great measure with those of the Abelians, Gnostics, Cerdonians, and other preachers of chastity and abstinence.

AGYRTÆ, in antiquity, a kind of strolling impostors, running about the country to pick up money, by telling fortunes at rich men's doors; pretending to cure diseases by charms, sacrifices, and other religious mysteries; also to expiate the crimes of their deceased ancestors, by virtue of certain odours and fumigations; to torment their enemies, by the use of magical verses, and the like. The word is Greek, *Αγυρται*, formed of the verb *αγυρω*, "I congregate;" alluding to the practice of charlatans or quacks, who gather a crowd about them.

Agyrtae, among the Greeks, amount to the same with *Æruscatores* among the Latins, and differ not much from gypsies among us.

AHAB, son of Omri king of Israel, succeeded his father A. M. 3086, and surpassed all his predecessors in impiety and wickedness. He married Jezebel the daughter of Ethbaal king of the Zidonians, who introduced the idols of Baal and Astarte among the Israelites, and engaged Ahab in the worship of these false deities. God, being provoked by the sins of Ahab, sent the prophet Elijah to him (1 Kings xvii. 1. seq.), who declared to him, that there would be a famine of three years continuance. The dearth having lasted three years, the prophet desired Ahab to gather all the people to Mount Carmel, and with them the prophets of Baal: when they were thus assembled, Elijah caused fire to descend from heaven upon his sacrifice, after which he obtained of God that it should rain; and then the earth recovered its former fertility. Six years after this, Ben-hadad king of Syria (chap. xx.) laid siege to Jerusalem. But God, provoked at this proud Syrian, sent a prophet to Ahab, not only

Agusadura
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Ahab.

Ahab.

to assure him of victory, but to instruct him likewise in what manner he was to obtain it. Ahab was ordered to review the princes of the provinces, which he found to be a choice company, consisting of 232 young men, who were to command the people in Samaria, amounting to about 7000 men; with this small army Ahab was directed to fall upon the great host of the Syrians, and that at noon-day, while Ben-hadad and the 32 kings that accompanied him were drinking and making merry. Ben-hadad having notice that they were marching out of the city, ordered them to be brought before him alive, whatever their designs were; but the young men, followed by this small army, advanced, and killed all that opposed them. Such a panic seized the Syrian troops, that they began to fly, and even Ben-hadad himself mounted his horse and fled with his cavalry: which Ahab perceiving, pursued them, killed great numbers of them, and took a considerable booty. After this the prophet came to Ahab, to animate him with fresh courage, and to caution him to keep upon his guard; assuring him, that Ben-hadad would return against him the year following. According to this prediction, at the end of the year he returned and encamped at Aphek, with a resolution to give the Israelites battle. Both armies being ranged in order of battle for seven days successively, at length upon the seventh day, a battle ensued, wherein the Israelites killed 100,000 of the Syrians, and the rest fled to Aphek; but as they were pressing to get into the city, the walls of Aphek fell upon them and killed 27,000 more. Ben-hadad throwing himself upon the mercy of Ahab, this prince received him into his own chariot, and made an alliance with him. The year following, Ahab desiring to make a kitchen garden near his palace (chap. xxi.), requested of one Naboth, a citizen of Jezreel, that he would sell him his vineyard, because it lay convenient for him. But being refused, he returned in great discontentment to his house, threw himself upon the bed, turned towards the wall, and would eat nothing. Jezebel his wife coming in, asked the reason of his great concern; of which being informed, she procured the death of Naboth, and Ahab took possession of his vineyard. As he returned from Jezreel to Samaria, the prophet Elijah met him, and said, "Hast thou killed and also taken possession? Now saith the Lord, In the place where dogs licked up the blood of Naboth, shall dogs lick thy blood, even thine. As for Jezebel, of her the Lord spoke, saying, The dogs shall eat Jezebel by the way of Jezreel." Ahab, hearing these and other denunciations, rent his clothes, put sackcloth upon his flesh, and gave other indications of his sorrow and repentance. But his repentance was neither sincere nor persevering. Two years after these things, Jehoshaphat king of Judah came to Samaria to visit Ahab (chap. xxii.) at a time when he was preparing to attack Ramoth-gilead, which Ben-hadad king of Syria unjustly withheld from him. The king of Israel invited Jehoshaphat to accompany him in this expedition; which that prince agreed to do, but desired that some prophet might first be consulted. Ahab therefore assembled the prophets of Baal, in number about 400; who all concurred in exhorting the king to march resolutely against Ramoth-gilead. But Micaiah being also consulted, at Jehoshaphat's suggestion, prophesied the ruin of Ahab. Upon this, Ahab

gave orders to his people to seize Micaiah, and to carry him to Amon the governor of the city, and to Joash the king's son; telling him in his name, "Put this fellow in prison, and feed him with the bread of affliction, and with the water of affliction, until I come in peace." But Micaiah said, "If thou return at all in peace, the Lord hath not spoken by me." Ahab, therefore, and Jehoshaphat, marched up to Ramoth-gilead; and the king of Israel said unto Jehoshaphat, "I will disguise myself, and enter into the battle, but put thou on my robe:" for he knew that the king of Syria had commanded two-and-thirty captains that had rule over his chariots, saying, "Fight neither with small nor with great, save only with the king of Israel." These officers, therefore, having observed that Jehoshaphat was dressed in royal robes, took him for the king of Israel, and fell upon him with great impetuosity: but this prince seeing himself pressed so closely, cried out; and the mistake being discovered, the captains of the king of Syria gave over pursuing him. But one of the Syrian army shot a random arrow, which pierced the heart of Ahab. The battle lasted the whole day, and Ahab continued in his chariot with his face turned towards the Syrians. In the mean time, his blood was still issuing from his wound, and falling in his chariot; and towards the evening he died: whereupon proclamation was made, by the sound of trumpet, that every man should return to his own city and country. The king of Israel being dead, was carried to Samaria and buried: but his chariot and the reins of his horses were washed in the fish-pool of Samaria, and the dogs licked his blood, according to the word of the prophet. Such was the end of Ahab. His son Ahaziah succeeded him, in the year of the world 3107.

AHÆTULA, the trivial name of a species of the coluber. See COLUBER.

AHASUERUS, or ARTAXERXES, the husband of Esther; and, according to Archbishop Usher and F. Calmet, the Scripture name for Darius the son of Hystaspes, king of Persia; though Scaliger supposed Xerxes to have been the husband of Esther, or the Ahasuerus of Scripture: and Dr Prideaux believes him to be Artaxerxes Longimanus. See History of PERSIA.

AHAZ, king of Judah, the son of Jotham; remarkable for his vices and impieties. One of his sons he consecrated, by making him pass through and perish by the fire, in honour of the false god Moloch; and he offered sacrifices and incense upon the high places, upon hills, and in groves. Rezin king of Syria and Pekah king of Israel invaded Judah in the beginning of the reign of Ahab; and having defeated his army and pillaged the country, they laid siege to Jerusalem. When they found that they could not make themselves masters of that city, they divided their army, plundered the country, and made the inhabitants prisoners of war. Rezin and his part of the confederate army marched with all their spoil to Damascus; but Pekah with his division of the army having attacked Ahab, killed 120,000 men of his army in one battle, and carried away men, women, and children, without distinction, to the number of 200,000. But as they were carrying those captives to Samaria, the prophet Oded, with the principal inhabitants of the city, came out to meet

Ahab
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Ahaz.

Ahaz
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Ahijah.

meet them; and by their remonstrances prevailed with them to set their prisoners at liberty. At the same time, the Philistines and Edomites invaded other parts of his land, killed multitudes of the people, and carried off much booty. In this distressed condition, Ahaz finding no other remedy for his affairs, sent ambassadors to Tiglath-pileser king of the Assyrians; and to engage him to his interest, he stripped the temple and city of all the gold which he could meet with, and sent it as a present. Accordingly Tiglath-pileser marched to the assistance of Ahaz, attacked Rezin and killed him, took his capital Damascus, destroyed it, and removed the inhabitants thereof to Cyrene.

The misfortunes of this prince had no influence to make him better; on the contrary, in the times of his greatest affliction, he sacrificed to the Syrian deities, whom he looked upon as the authors of his calamities, and endeavoured to render propitious to him, by honouring them in this manner. He broke in pieces the vessels of the house of God, shut up the gates of the temple, and erected altars in all parts of Jerusalem. He set up altars likewise in all the cities of Judah, with a design to offer incense on them. At length he died, and was buried in Jerusalem, but not in the sepulchres of the kings of Judah his predecessors: which honour he was deprived of on account of his iniquitous course of life. Hezekiah his son succeeded him in the year of the world 3287, before Jesus Christ 726.

AHAZIAH, the son and successor of Ahab king of Israel, reigned two years, part alone and part with his father Ahab, who ordained him his associate in the kingdom a year before his death. Ahaziah imitated his father's impieties (1 Kings xxii. 52. *seq.*), and paid his adoration to Baal and Astarte, the worship of whom had been introduced in Israel by Jezebel his mother. The Moabites, who had been always obedient to the kings of the ten tribes ever since their separation from the kingdom of Judah, revolted after the death of Ahab, and refused to pay the ordinary tribute. Ahaziah had not leisure or power to reduce them (2 Kings i. 1, 2, &c.); for about the same time, having fallen through a lattice from the top of his house, he hurt himself considerably, and sent messengers to Ekron, in order to consult Baalzebub, the god of that place, whether he should recover of the indisposition occasioned by this accident. But the prophet Elijah went to Ahaziah, and declared that he should not recover from his illness: and accordingly he died in the year of the world 3108, and Jehoram his brother succeeded to the crown.

AHAZIAH, king of Judah, the son of Jehoram and Athaliah, succeeded his father in the kingdom of Judah, in the year of the world 3119. He walked in the ways of Ahab's house, to which he was allied. He reigned only one year. He was slain by Jehu the son of Nimshi.

AHEAD, a sea term, signifying further onward than the ship, or at any distance before her, lying immediately on that point of the compass to which her stem is directed. It is used in opposition to *astern*, which expresses the situation of any object behind the ship.

AHIJAH, the prophet of Shilo. He is thought to be the person who spoke twice to Solomen from

God, once while he was building the temple (1 Kings vi. 11.), at which time he promised him his protection; and at another time (*id.* xi. 6.) after his falling into all his irregularities, when God expressed his indignation with great threatenings and reproaches. Ahijah was one of those who wrote the annals or history of this prince (2 Chr. ix. 29.). The same prophet declared to Jeroboam that he would usurp the kingdom (1 Kings xi. 29. &c.), and that two heifers should alienate him from the Lord, meaning the golden calves erected by Jeroboam, one at Dan, the other at Bethel. About the end of Jeroboam's reign, towards the year of the world 3046, Abijah the son of that prince fell sick; upon which Jeroboam sent his wife to this prophet to inquire what would become of the child. The queen therefore went to Ahijah's house in Shilo, disguised: But the prophet, upon hearing the sound of her feet, said, "Come in, thou wife of Jeroboam, why feignest thou thyself to be another? for I am sent to thee with heavy tidings." Then he commanded her to go and tell Jeroboam all the evil that the Lord had declared he would bring upon his house for his impieties; that so soon as she should enter into the city her son Abijah should die, and should be the only one of Jeroboam's house that should come to the grave or receive the honours of a burial. Ahijah in all probability did not long survive the time of this last prophecy; but with the time and manner of his death we are not acquainted.

AHITOPHEL, a native of Gillo, was for some time the counsellor of King David, whom he at length deserted, by joining in the rebellion of Absalom. This prince, upon his being preferred to the crown by the greatest part of the Israelites, sent for Ahitophel from Gillo (2 Sam. xv. 12.) to assist him with his advice in the present state of his affairs: for at that time Ahitophel's counsels were received as the oracles of God himself (chap. xvi. *ult.*). Nothing gave David more uneasiness than this event; and when Hushai his friend came to wait on him and attend him in his flight, he intreated him to return rather to Jerusalem, make a show of offering his services to Absalom, and endeavour to frustrate the prudent measures which should be proposed by Ahitophel. When Absalom was come to Jerusalem, he desired Ahitophel to deliberate with his other counsellors upon the measures which were proper for him to take. Ahitophel advised him in the first place to abuse his father's concubines; so that when his party should understand that he had dishonoured his father in this manner, they might conclude that there were no hopes of a reconciliation, and therefore espouse his interest more resolutely. A tent, therefore, being prepared for this purpose upon the terrace of the king's palace, Absalom, in the sight of all Israel, lay with his father's concubines. The next thing Ahitophel proposed was in the terms following: "Let me now choose out 12,000 men, and I will arise and pursue after David this night, and I will come upon him while he is weary and weak-handed, and I will make him afraid, and all the people that are with him flee, and I will smite the king only; and I will bring back all the people unto thee; the man whom thou seekest is as if all returned: so all the people shall be in peace." This advice was very agreeable to Absalom and all the elders of Israel. However, Absalom

Ahijah.

Ahitophel Absalom desired Hushai to be called to have his opinion. Hushai being come, and hearing what advice Ahitophel had given, said, "The counsel which Ahitophel has given is not good at this time; what, for the present in my opinion, may do better, is this: Let all Israel be gathered unto thee, from Dan even to Beersheba, as the sand that is by the sea for multitude, and put thyself in the midst of them, and wherever David is, we may fall upon him, and overwhelm him with our numbers, as the dew falleth upon the ground." The last advice being more agreeable to Absalom and all the elders of Israel, was preferred; upon which Ahitophel saddled his ass, went to his house at Gillo, hanged himself, and was buried in the sepulchre of his fathers. He foresaw, without doubt, all that would happen in consequence of Hushai's advice, and was determined to prevent the death which he had deserved, and which David would probably have inflicted on him, as soon as he should be resettled on his throne.

AHMELLA, in *Botany*. See **BIDENS**, *BOTANY Index*.

AHOLIBAH and **AHOLAH**, are two feigned names made use of by Ezekiel (xxiii. 4.) to denote the two kingdoms of Judah and Samaria. Aholah and Aholibah are represented as two sisters of Egyptian extraction. Aholah stands for Samaria, and Aholibah for Jerusalem. The first signifies a *tent*; and the second, *my tent is in her*. They both prostituted themselves to the Egyptians and Assyrians, in imitating their abominations and idolatries; for which reason they were abandoned to those very people for whom they had shown so passionate and so impure an affection; they were carried into captivity, and reduced to the severest servitude.

AHULL, in the sea-language, the situation of a ship when all her sails are furled on account of the violence of the storm, and when having lashed her helm on the lee-side, she lies nearly with her side to the wind and sea, her head being somewhat inclined to the direction of the wind.

AHUN, a town of France, in the Upper Marche and generality of Moulins, in the department of Creuse. It is seated on the river Creuse, eight miles south-east of Gueret, 30 north-east of Lomages, and 55 south-east of Moulins. E. Long. 1. 52. N. Lat. 49. 5.

AHUYS, a town of Gothland in Sweden. It is small, but very strong by its situation, and has a good port. It is in the principality of Gothland, in the territory of Blekingy, near the Baltic sea, about 18 miles from Christianstadt. E. Long. 14. 10. N. Lat. 56. 20.

AI, in *Ancient Geography*, a town in Judea, to the north of Jericho, called *Aia* by Josephus, and the inhabitants *Ainatæ*. Joshua having sent a detachment of 3000 men against Ai, God permitted them to be repulsed on account of Achan's sin, who had violated the anathema pronounced against the city of Jericho. But after the expiation of this offence, God commanded Joshua (chap. viii.) to march with the whole army of the Israelites against Ai, and treat this city and the kingdom thereof as he had treated Jericho, with this difference, that he gave the plunder of the town to the people. Joshua sent by night 30,000 men to lie in ambush behind Ai; having first well instructed those

who had the command of them in what they were to do; and the next day, early in the morning, he marched against the city with the remainder of his army. The king of Ai, perceiving them, sallied hastily out of the town with all his people, and fell upon the forces of the Israelites, who, upon the first onset, fled, as if they had been under some great terror.

As soon as Joshua saw the enemy all out of the gates, he raised his shield upon the top of a pike, which was the signal given to the ambuscade; whereupon they immediately entered the place, which they found without defence, and set fire to it. The people of Ai perceiving the smoke ascending, were willing to return, but discovered those who had set fire to the city in their rear, while Joshua and those who were with him turning about, fell upon them, and cut them in pieces. The king was taken alive, and afterwards put to death.

The chevalier Folard observes, that Joshua's enterprise on Ai, excepting in some particulars of military art, is very like that of Gibeah, which is scarcely any thing more than a copy of it. It would appear, says that writer, by the Scripture account, that Joshua was not the author of the stratagem made use of by him: for when God directs himself to Joshua, he says, "Go up against Ai; lay an ambuscade behind the town; I have delivered the king and the people of it into thine hands:" yet notwithstanding this, God might leave the whole glory of the invention and execution of it to him, as to a great general. "Joshua arose, (says the sacred author), and all the people of war, to go up against Ai (verse 3.); and Joshua chose out 30,000 mighty men of valour, and sent them away by night." Folard remarks, that there is a manifest contradiction between this verse and the 12th, wherein it is said that Joshua chose out 500 men, whom he sent to lie in ambush, between Bethel and Ai. How is this to be reconciled? Calmet says, that Masius allows but 5000 men for the ambuscade, and 25,000 for the attack of the city, being persuaded that an army of 60,000 men could only create confusion on this occasion, without any necessity for, or advantage in, such numbers; but the generality of interpreters, continues Calmet, acknowledge two bodies to be placed in ambuscade, both between Bethel and Ai; one of 25,000 and the other of 5000 men.

With regard to the signal Joshua made to that part of his army which lay in ambuscade, the learned Folard embraces the opinion of the Rabbins, who believe what is called the shield to be too small to serve for a signal: hence they make it to be the staff of one of their colours; from this, our author concludes, that the whole colours were used on this occasion; for in the Asiatic style, which is very near the poetic, a part is oftentimes to be taken for the whole.

AJALON, in *Ancient Geography*, a town of the tribe of Dan, one of the Levitical. Another in the tribe of Benjamin, in whose valley Joshua commanded the moon to stand still, being then in her decrease, and consequently to be seen at the same time with the sun.

AJAN, a coast and country of Africa, has the river Quilmanci on the south; the mountains from which the river springs, on the west; Abyssinia, or Ethiopia, and the strait of Babelmandel, on the north; and the Eastern or Indian ocean, on the east. The

Ai
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Ajan.

Ajan
||
Aichstat.

coast abounds with all necessaries of life, and has plenty of very good horses. The kings of Ajan are often at war with the emperor of the Abyssins; and all the prisoners they take they sell to the merchants of Cambaya, those of Aden, and other Arabs, who come to trade in their harbours, and give them in exchange, coloured cloths, glass-beads, raisins, and dates; for which they also take back, besides slaves, gold and ivory. The whole sea coast, from Zanguebar to the strait of Babel-mandel, is called the coast of Ajan; and a considerable part of it is styled the Desert coast.

AJAX, the son of Oileus, was one of the principal generals who went to the siege of Troy. He ravished Cassandra the daughter of Priam, even in the temple of Minerva, where she thought to have found sanctuary. It is said, he made a serpent of 15 feet long so familiar with him, that it ate at his table, and followed him like a dog. The Locrians had a singular veneration for his memory.

AJAX, the son of Telamon, was, next to Achilles, the most valiant general among the Greeks at the siege of Troy. He commanded the troops of Salamis, and performed many great actions, of which we have an account in the Iliad, in *Diety's Cretensis*, and in the 23d book of Ovid's *Metamorphoses*. He was so enraged, that the arms of Achilles were adjudged to Ulysses, that he immediately became mad. The Greeks paid great honour to him after his death, and erected a magnificent monument to his memory upon the promontory of Rhetium.

AJAX, in antiquity, a furious kind of dance, in use among the Grecians; intended to represent the madness of that hero after his defeat by Ulysses, to whom the Greeks had given the preference in his contest for Achilles's arms. Lucian, in his treatise of Dancing, speaks of dancing the *Ajax*.—There was also an annual feast called *Ajantia*, *Ajaxia*, consecrated to that prince, and observed with great solemnity in the island of Salamis, as well as in Attica; where, in memory of the valour of Ajax, a bier was exposed, set out with a complete set of armour.

AJAZZO, or AJACCIO, a sea-port of the island of Corsica, in the Mediterranean, and now the chief town of the island. It is situated in a fertile territory, which produces excellent wines. It has a small citadel, and an excellent harbour. The number of inhabitants in 1815 was 6845; many of them are Greeks. It has some trade in timber, &c. and is remarkable for being the birth-place of Napoleon Bonaparte. E. Long. 8. 50. N. Lat. 41. 50.

AJAZZO, a sea-port town of Natolia, in the province of Caramania, anciently Cilicia, seated on the coast of the Mediterranean, 30 miles north of Antioch and 50 west of Aleppo, where the city of Issus anciently stood, and near which Alexander fought his second battle with Darius. E. Long. 36. 10. N. Lat. 37. 0.

AICHSTAT, a town of Germany, in Franconia, and capital of a bishopric of the same name. It is remarkable for a curious piece of workmanship, called the Sun of the Holy Sacrament, which is in the church. It is of massy gold, of great weight; and is enriched with 350 diamonds, 1400 pearls, 250 rubies, and other precious stones. This place is moderately large, and seated in a valley on the river Altmul, 10 miles north

of Nienburg, and 37 south of Nuremberg. E. Long. 11. 10. N. Lat. 49. 0. The bishopric is 45 miles in length and 17 in breadth; and the bishop is chancellor of the church of Mayence or Mentz.

AID, in a general sense, denotes any kind of assistance given by one person to another.

AID, in *Law*, denotes a petition made in court to call in help from another person who has interest in land, or any thing contested.

Aid-de-Camp, in military affairs, an officer employed to receive and carry the orders of a general.

AID, *Auxilium*, in ancient customs, a subsidy paid by vassals to their lords on certain occasions. Such were the aid of relief, paid upon the death of the lord mesne to his heir; the *aid cheval*, or capital aid, due to the chief lord on several occasions, as, to make his elder son a knight, to make up a portion for marrying his daughter, &c.

AIDS, in the French customs, were certain duties, paid on all goods exported or imported into that kingdom.

Court of Aids, in France, a sovereign court formerly established in several cities, which had cognizance of all causes relating to the taxes, gabelles, and aids, imposed on several sorts of commodities, especially wine.

AIDS, in the manege, are the same with what some writers call *cherishings*, and used to avoid the necessity of corrections.—The inner heel, inner leg, inner rein, &c. are called *inner aids*; as the outer heel, outer leg, outer rein, &c. are called *outer aids*.

AIDAN, a famous Scottish bishop of Lindisfarne, or Holy Island, in the 7th century, was employed by Oswald king of Northumberland in the conversion of the English, in which he was very successful. He was a monk in the monastery of Jona, one of the Hebrides. He died in 651.

AIGHENDALE, the name of a liquid measure used in Lancashire, containing seven quarts.

AIGLE, a bailiwick in the territory of Romand in Switzerland, consists of mountains and valleys, the principal of which are the Aigle and Bex. Through these is the great road from Valais into Italy. When you pass by Villeneuve, which is at the head of the lake of Geneva, you enter into a deep valley three miles wide, bordered on one side with the Alps of Switzerland, on the other side with those of Savoy, and crossed by the river Rhone. Six miles from thence you meet with Aigle, a town containing 2500 inhabitants, seated in a wide part of the valley, where there are vineyards, fields, and meadows. The governor's castle is on an eminence that overlooks the town, and has a lofty marble tower. This government has nine large parishes; and is divided into four parts, Aigle, Bex, Olon, and Ormont. This last is among the mountains, and joins to Rougemont. It is a double valley, abounding in pasture-lands. Ivorna, in the district of Aigle, was in part buried by the fall of a mountain, occasioned by an earthquake, in 1584.

AIGLE, a small town of France, in Upper Normandy, 23 miles from D'Evereux, and 38 from Rouen, in the department of Orne. It is surrounded with walls and ditches, and has six gates, three suburbs and three parishes. It trades in corn, toys, and more particularly in needles and pins. E. Long. 0. 46. N. Lat. 48. 46.

AIGUILLON,

Aichstat
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Aigle.

Aiguillon
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Ailana.

AIGUILLON, a small town of France, in the province of Guienne, and department of Garonne and Lot, which has a considerable trade in wines, brandy, and hemp. E. Long. o. 22. N. Lat. 44. 45.

AIGUISCE, in *Heraldry*, denotes a cross with its four ends sharpened, but so as to terminate in obtuse angles. It differs from the cross fitchee, in as much as the latter tapers by degrees to a point, and the former only at the ends.

AIKMAN, WILLIAM, a painter of considerable eminence, was born in Scotland, October 24. 1682. He was the son of William Aikman, Esq. of Cairney, and was intended by his father to follow his own profession, which was that of an advocate at the Scotch bar. But the genius of the son led him to other studies. He devoted himself to the fine arts, especially that of painting, and having for some time prosecuted his studies in Britain, in the year 1707 he went to Italy, resided in Rome for three years, afterwards travelled to Constantinople and Smyrna, and in 1712 returned to his own country. About the year 1723 he fixed his residence in London, where he followed the profession of painting, and had the good fortune to be patronised by the duke of Argyle, the earl of Burlington, Sir Godfrey Kneller, and other liberal encouragers of the arts. He painted many portraits of persons of the first rank in England and Scotland; and a large picture of the royal family for the earl of Burlington, now in the possession of the duke of Devonshire, which was unfinished at his death. Some of his portraits painted in Scotland are in the possession of the duke of Argyle, the duke of Hamilton and others. Mr Aikman died in London, June 4. 1731. Six months previous to his death he had lost a son at the age of 17. The remains of both were removed to Edinburgh, and were interred in the Grayfriars churchyard on the same day. Mr Somerville, the author of the *Chace*, Mr Mallet, Mr Allan Ramsay the Scottish poet, and Mr Thomson, were among Mr Aikman's intimate acquaintance; and the muse of each, in elegiac numbers, offered a warm tribute to the memory of their departed friend. The following epitaph from the pen of Mr Mallet, was engraved on his tomb:

Dear to the good and wise, disprais'd by none,
Here sleep in peace the father and the son;
By virtue as by nature close ally'd,
The painter's genius, but without the pride:
Worth unambitious, wit afraid to shine,
Honour's clear light, and friendship's warmth divine:
The son fair rising knew too short a date;
But, oh! how more severe the father's fate!
He saw him torn untimely from his side,
Felt all a father's anguish—wept and died.

Mr Aikman's stile of painting was an imitation of the pleasing simplicity of nature. It is distinguished by softness of light, mellowness of shade, and mildness and harmony of colouring. His compositions have more placid tranquillity of ease, than boldness of touch and brilliancy of effect. His portraits are supposed to have some resemblance to those of Kneller, and not only in the imitation of the dresses of the time, but in the similarity of tint and manner of working.

AILANA, AILATH, or AHELOTH, anciently a town of Arabia Petræa, situated near the Sinus Ela-

nites of the Red sea. It was also called *Eliath*, and *Eloth* (Stephanus, Strabo, Moses). The same with *Elana*.

AILANTHUS, in *Botany*. See *BOTANY Index*.

AILE, in *Law*, a writ which lies where a person's grandfather, or great-grandfather, being seised of lands, &c. in fee-simple, the day that he died, and a stranger abates and enters the same day, and dispossesses the heir of his inheritance.

AILESBUURY, or AYLESBURY, a borough town in Buckinghamshire, containing with the parish 3447 inhabitants in 1810. In the middle of the market-place is a convenient hall, where the sessions are held. It sends two members to parliament; but being convicted of corruption in 1804, the right of voting was extended to the neighbouring hundreds. W. Long. o. 40. N. Lat. 51. 40.

AILMER, or ÆTHELMARE, earl of Cornwall and Devonshire, in the reign of King Edgar. It is not known of what family he was. His authority and riches were great, and so also in appearance was his piety. He founded the abbey of Cernel, in Dorsetshire; and had so great a veneration for Eadwald, the brother of St Edmund the Martyr, who had lived a hermit in that country, near the Silver Well, as they called it, that, with the assistance of Archbishop Dunstan, he translated his relics to the old church of Cernel. In 1016, when Canute, the son of Sueno, invaded England, and found himself stoutly opposed by that valiant Saxon prince Edmund Ironside, the son of Æthelred, this Earl Ailmer, with that arch traitor Eadric Streone, earl of Mercia, and Earl Algar, joined the Dane against their natural prince, which was one great cause of the Saxons ruin. He did not long survive this; and we find mentioned in history only one son of his, whose name was Æthelward, earl of Cornwall, who followed his father's maxims, and was properly rewarded for it. For in 1018, Canute reaping the benefit of their treasons, and perceiving that the traitors were no longer useful, he caused the infamous Eadric Streone, and this Earl Æthelward, to be both put to death.

AILRED, or EALRED, abbot of Revesby in Lincolnshire, in the reigns of Stephen and Henry II. He was born in 1109, of a noble family, and educated in Scotland with Henry the son of King David. On his return to England, he became a monk of the Cistercian order, in the monastery of Revesby, of which he afterwards was made abbot. He died on the 12th of January 1166, aged 57, and was buried in his monastery. "He was (says Leland) in great esteem during his life; celebrated for the miracles wrought after his death; and admitted into the catalogue of saints." He was author of several works; most of which were published by Gilbo the Jesuit at Douay, 1631; part of them may be also found in the *Bibliotheca Cisterciensis*, and *Bibliotheca Patrum*. His principal work is the *Speculum Charitatis*. Leland, Bale, and Pits, mention several manuscripts which never were published.

AILSÀ, an insulated rock on the western coast of Scotland, between the shores of Ayrshire and Cantire. It is two miles in circumference at the base, is accessible only at one place, and rises in a pyramidal form to the height of 940 feet. A few goats and rabbits pick up a subsistence among the short grass and

Ailana
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Ailsa.

Ailsa
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Air.

furze; but it is frequented by immense numbers of solan geese, and other birds, which are valued for their flesh or feathers. The depth of water around the base is from 7 to 48 fathoms. On one part of the rock are the remains of an old castle, which is said to have been erected by Philip II. of Spain, about the time that the Spanish armada invaded Britain.

AIN, a department in the south-east of France, adjoining to Switzerland. The surface is rocky and mountainous, and affords scarcely one-third of arable land. They raise many cattle, and have a few trifling manufactures. The territorial extent of this department is 289 square leagues, or 549,905 hectares. The population in 1817 was 322,608. Bourg is the chief town.

AINSWORTH, DR HENRY, an eminent nonconformist divine, who, about the year 1590, distinguished himself among the Brownists; which drew upon him such troubles that he was obliged to retire to Holland, and became minister of a church at Amsterdam. His skill in the Hebrew language, and his excellent Annotations on the Holy Scriptures, which are still highly esteemed, gained him great reputation. He also wrote several pieces in defence of the Brownists, and several other works.

AINSWORTH, Robert, born at Woodyale in Lancashire in 1660, was master of a boarding school at Bethnal green, from whence he removed to Hackney, and to other places in the neighbourhood of London. After acquiring a moderate fortune, he retired, and lived privately to the time of his death, which happened in 1743. We are indebted to his industry for a Latin and English Dictionary, which has been much used in schools: he published it in quarto 1736; and in 1752, the fourth edition, under the care of Dr Ward of Gresham College, and the Rev. William Younge, was enlarged to two vols. folio.

AIR, in *Physics*. See ATMOSPHERE, METEOROLOGY, and PNEUMATICS.

AIR, in *Mythology*, was adored by the Heathens under the names of Jupiter and Juno; the former representing the superior and finer part of the atmosphere, and the latter the inferior and grosser part. The augurs also drew presages from the clouds, thunder, &c.

AIR, in *Painting*, &c. denotes the manner and very life of action; or it is that which expresses the disposition of the agent.—It is sometimes also used in a synonymous sense with gesture or attitude.

AIR, in *Music*, is taken in different senses. It is sometimes contrasted with harmony; and in this sense, it is synonymous with melody in general.—Its proper meaning is, A tune, which is set to words, or to short pieces of poetry that are called *songs*.

In operas, we give the name of *air* to such pieces of music as are formed with measures and cadences, to distinguish it from the recitative; and, in general, every piece of music is called an *air*, which is formed for the voice, or even for instruments, and adapted to stanzas, whether it forms a whole in itself, or whether it can be detached from any whole of which it forms a part, and be executed alone.

If the subject admits of harmony, and is set in parts, the *air* is, according to their number, denominated a *duett*, a *trio*, a *quartetto*, &c. We need not follow Rousseau, and the other philologists, in their endeavours to investigate the etymon of the word *air*. Its deriva-

tion, though found and ascertained, would contribute little to illustrate its meaning in that remote sense, to which, through a long continuance of time, and the various vicissitudes of language, it has now passed. The curious may consult the same article in the *Dictionnaire de Musique* by M. Rousseau.

In modern music, there are several different kinds of *airs*, each of which agrees to a certain kind of dancing; and from these dances the *airs* themselves take their specific names.

The *airs* of our operas are, if we may be permitted the expression, the canvas or substratum upon which are painted all the pictures of imitative music; melody is the design, and harmony the colouring; every picturesque object selected from the most beautiful parts of nature, every reflected sentiment of the human heart, are the models which the artist imitates; whatever gains attention, whatever interests the soul, whatever charms the ear, or causes emotion in the heart, these are the objects of his imitation. An *air* which delights the ear, and discovers the learning of the composer; an *air* invented by genius, and composed with taste; is the noblest effort of music: it is this which explores the compass, and displays the delicacy, of a beautiful voice; it is in this where the charms of a well conducted symphony shine; it is by this, that the passions, excited and inflamed by nice gradations, reach and agitate the soul through the avenues of external sense. After hearing a beautiful *air*, the mind is acquiescent and serene: the ear is satisfied, not disgusted; it remains impressed on the fancy, it becomes a part of our essence, we carry it with us, we are able to repeat it at pleasure: without the ability acquired by habit to breathe a single note of it, we execute it in our imagination in the same manner as we heard it upon the theatre: one sees the scene, the actor, the theatre; one hears the accompaniments and the applauses. The real enthusiast in music never forgets the beautiful *airs* which he has heard; when he chooses, he causes the opera to recommence.

The words to which *airs* are adapted are not always rehearsed in regular succession, nor spoken in the same manner with those of the recitative; and though, in general, they are very short, yet they are interrupted, repeated, transposed, at the pleasure of the artist. They do not constitute a narrative, which once told is over; they either delineate a picture, which it is necessary to contemplate in different points of view; or inspire a sentiment in which the heart acquiesces with pleasure, and from which it is neither able nor willing to be disengaged; and the different phrases of the *air*, are nothing else but different manners of beholding the same image. This is the reason why the subject of an *air* should be one. It is by these repetitions properly placed, it is by these redoubled efforts, that an impression, which at first was not able to move you, at length shakes your soul, agitates you, transports you out of yourself: and it is likewise upon the same principle, that the runnings, as they are called, or those long, mazy, and inarticulated inflections of the voice, in pathetic *airs*, frequently seem, though they are not always so, improperly placed: for whilst the heart is affected with a sentiment exquisitely moving, it often expresses its emotions by inarticulate sounds, more strongly and sensibly than it could do by words themselves.

Air.

Air
Pipes.

The form of *airs* is of two kinds. The small *airs* are often composed of two strains, which ought each of them to be sung twice ; but the important *airs* in operas are frequently in the form of *rondeaux*.

AIR, in *Geography*. See *AYR*.

Air-Bladder, in fishes. See *COMPARATIVE ANATOMY* and *ICHTHYOLOGY Index*.

Air-Gun, a pneumatic machine for exploding bullets, &c. with great violence. See *PNEUMATICS*.

Air-Jacket, a sort of jacket made of leather, in which are several bags, or bladders, composed of the same materials, communicating with each other. These are filled with air through a leather tube, having a brass stop-cock accurately ground at the extremity, by which means the air blown in through the tube is confined in the bladders. The jacket must be wet before the air be blown into the bags, as otherwise it will immediately escape through the pores of the leather. By the help of these bladders, which are placed near the breast, the person is supported in the water, without making the efforts used in swimming.

Air-Pipes, an invention for drawing foul air out of ships, or any other close places, by means of fire. These pipes were first found out by one Mr Sutton, a brewer in London ; and from him have got the name of *Sutton's Air-Pipes*. The principle on which their operation depends is known to every body, being, indeed no other than that air is necessary for the support of fire ; and, if it has not access from the places most adjacent, will not fail to come from those that are more remote. Thus, in a common furnace, the air enters through the ash-hole ; but if this is closed up, and a hole made in the side of the furnace, the air will rush in with great violence through that hole. If a tube of any length whatever be inserted in this hole, the air will rush through the tube into the fire, and of consequence there will be a continual circulation of air in that place where the extremity of the tube is laid. Mr Sutton's contrivance, then, as communicated to the Royal Society by Doctor Mead, amounts to no more than this : " As, in every ship of any bulk, there is already provided a copper or boiling place proportionable to the size of the vessel ; it is proposed to clear the bad air, by means of the fire already used under the said coppers or boiling places for the necessary uses of the ship.

" It is well known, that under every such copper or boiler, there are placed two holes, separated by a grate ; the first of which is for the fire, and the other for the ashes falling from the same ; and that there is also a flue from the fire-place upward, by which the smoke of the fire is discharged at some convenient place of the ship.

" It is also well known, that the fire once lighted in these fire-places, is only preserved by the constant draught of air through the fore-mentioned two holes and flue ; and that if the said two holes are closely stopped up, the fire, though burning ever so briskly before, is immediately put out.

" But if, after shutting up the above mentioned holes, another hole be opened, communicating with any other room or airy place, and with the fire ; it is clear the said fire must again be raised and burn as before, there being a light draught of air through the same as there was before the stopping up of the first holes ;

this case differing only from the former in this, that the air feeding the fire will now be supplied from another place. Air-Pipes.

" It is therefore proposed, that, in order to clear the holds of ships of the bad air therein contained, the two holes above mentioned, the fire-place and ash-place, be both closed up with substantial and tight iron doors ; and that a copper or leaden pipe, of sufficient size, be laid from the hold into the ash-place, for the draught of air to come in that way to feed the fire. And thus it seems plain, from what has been already said, that there will be, from the hold, a constant discharge of the air therein contained ; and consequently, that that air, so discharged, must be as constantly supplied by fresh air down the hatches or such other communications as are opened into the hold ; whereby the same must be continually freshened, and its air rendered more wholesome and fit for respiration.

" And if into this principal pipe so laid into the hold, other pipes are let in, communicating respectively either with the well or lower decks ; it must follow, that part of the air consumed in feeding the fire, must be respectively drawn out of all such places to which the communication shall be so made."

This account is so plain, that no doubt can remain concerning the efficacy of the contrivance : it is evident, that, by means of pipes of this kind, a constant circulation of fresh air would be occasioned through those places where it would otherwise be most apt to stagnate and putrefy. Several other contrivances have been used for the same purpose ; and Dr Hales's ventilators, by some unaccountable prejudice, have been reckoned superior in efficacy and even simplicity to Mr Sutton's machine, which at its first invention met with great opposition, and even when introduced by Dr Mead, who used all his interest for that purpose, was shamefully neglected.

A machine capable of answering the same purpose was invented by Mr Desaguliers, which he called the *ship's lungs*. It consisted of a cylindrical box set up on its edge, and fixed to a wooden pedestal. From the upper edge of the box issued a square trunk, open at the end, and communicating with the cavity of the box. Within this box was placed a cylindrical wheel turning on an axis. It was divided into 12 parts by means of partitions placed like the radii of a circle. These partitions did not extend quite to the centre, but left an open space of about 18 inches diameter in the middle ; towards the circumference, they extended as far as possible without interfering with the case, so that the wheel might always be allowed to turn freely. Things being thus circumstanced, it is plain, that if the wheel was turned towards that side of the box on which the trunk was, every division would push the air before it, and drive it out through the trunk, at the same time that fresh air would come in through the open space at the centre, to supply that which was thrown out through the trunk. By turning the wheel swiftly, a strong blast of air would be continually forced out through the square trunk, on the same principles on which a common fanner winnows corn. If the wheel is turned the opposite way, a draught of air may be produced from the trunk to the centre. If this machine, then, is placed in a room where a circulation of air is wanted, and the trunk made to pass through one

Air Pump
Air-Shafts: of the walls; by turning the wheel swiftly round, the air will be forced with great velocity out of that room at the same time that fresh air will enter through any chinks by which it can have access to supply that which has been forced out.

It is evident, that the circulation which is promoted by this machine is entirely of the same kind with that produced by Mr Sutton's; the turning of the wheel in Mr Desagulier's machine being equivalent to the rarefaction of the air by fire in Mr Sutton's: but that the latter is vastly superior, as acting of itself, and without intermission, requires no arguments to prove. Mr Sutton's machine has yet another conveniency, of which no other contrivance for the same purpose can boast; namely, that it not only draws out putrid air, but destroys it by causing it pass through fire; and experience has abundantly shown, that though putrid air is thrown into a great quantity of fresh air, it is so far from losing its pernicious properties, that it often produces noxious diseases. We do not say, indeed, that putrid air becomes salutary by this means; but it is undoubtedly rendered less noxious than before; though whether it is equally innocent with the smoke of a fire fed in the common way, we cannot pretend to determine.

Besides this machine by Mr Desaguliers, the ventilators of Dr Hales, already mentioned, and those called *wind-sails*, are likewise used for the same purpose. The former of which is an improvement of the Hessian bellows: the other is a contrivance for throwing fresh air into those places where putrid air is apt to lodge; but this has the last mentioned inconvenience in a much greater degree than any of the others, as the blast of fresh air throws out that which was rendered putrid by stagnation, in such a manner as to contaminate all around it.

Air-Pump, a machine by which the air contained in a proper vessel may be exhausted or drawn out. See PNEUMATICS.

Air-Sacs, in *Birds*. See COMPARATIVE ANATOMY.

Air-Shafts, among *Miners*, denote holes or shafts let down from the open air to meet the adits and furnish fresh air. The damps, deficiency, and impurity of air which occur, when adits are wrought 30 or 40 fathoms long, make it necessary to let down air-shafts, in order to give the air liberty to play through the whole work, and thus discharge bad vapours, and furnish good air for respiration; the expence of which shafts, in regard of their vast depths, hardness of the rock, drawing of water, &c. sometimes equals, nay exceeds, the ordinary charge of the whole adit.

Sir Robert Murray describes a method, used in the coal mines at Liege, of working mines without air-shafts.

When the miners at Mendip have sunk a groove, they will not be at the charge of an air-shaft till they come at ore; and for the supply of air have boxes of elm exactly closed, of about six inches in the clear, by which they carry it down about twenty fathoms. They cut a trench at a little distance from the top of the groove, covering it with turf and rods disposed to receive the pipe, which they contrive to come in sideways to their groove, four feet from the top, which carries down the air to a great depth. When they come at ore, and need an air-shaft, they sink it four or five fathoms distant, according to the convenience of the

breadth, and of the same fashion with the groove, to draw ore as well as air.

Air-Threads, in *Natural History*, a name given to the long filaments, so frequently seen in autumn floating about in the air.

These threads are the work of spiders, especially of that species called the long-legged field-spider; which having mounted to the summit of a bush or tree, darts from its tail several of these threads, till one is produced capable of supporting the creature in the air: on this it mounts in quest of prey, and frequently rises to a very considerable height. See ARANEA.

Air-Trunk, is also a contrivance by Dr Hales, to prevent the stagnation of putrid effluvia in jails and other places, where a great number of people are crowded together in a small space. It consists only of a long square trunk open at both ends; one of which is inserted into the ceiling of the room, the air of which is required to be kept pure; and the other extends a good way beyond the roof. Through this trunk a continued circulation is carried on: and the reason is, that the putrid effluvia which do so much mischief when collected, being much lighter than the pure atmosphere, arise to the top of the room; and, if they there find a vent, will continually go out through it. These effluvia arise in very considerable quantity, being calculated by the late Dr Keil at no less than 39 ounces from one man in 24 hours.

These trunks were first made trial of by Mr Yeoman, over the House of Commons, where they were nine inches wide within; and over the Court of King's Bench in Westminster-hall, where they were six inches wide. They are sometimes made wider, and sometimes narrower: but the wider they are the longer they ought to be, more effectually to promote the ascent of the vapour. The reason why vapours of this kind ascend more swift through a long trunk than a short one, is, that the pressure of fluids is always according to their different depth, without regard to the diameter of their basis, or of the vessel which contains them; and, upon this principle, a gallon of water may be made to split a strong cask. See HYDROSTATICS. When the column of putrid effluvia is long and narrow, the difference between the column of atmosphere pressing on the upper end of the trunk, and that which presses on the lower end, is much greater than if the column of putrid effluvia was short and wide; and consequently the ascent is much swifter.—One pan of a single pair of scales; which was two inches in diameter, being held within one of these trunks over the House of Commons, the force of the ascending air made it rise so as to require four grains to restore the equilibrium, and this when there was no person in the house; but when it was full, no less than 12 grains were requisite to restore the equilibrium; which clearly shows that these trunks must be of real and very great efficacy.

Air-Vessels, are spiral ducts in the leaves, &c. of plants, supposed to be analogous to the lungs of animals, in supplying the different parts of a plant with air. See BOTANY Index.

AIRA, in *Botany*, HAIR-GRASS. See BOTANY Index.

AIRANI, in *Church History*, an obscure sect of Arians in the fourth century, who denied the consubstantiality of the Holy Ghost with the Father and the Son. They are otherwise called *Airanists*; and are said to have

Airani
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Aiton.

have taken their name from one *Airos*, who distinguished himself at the head of this party, in the reigns of Valentinian and Gratian.

AIRE, in *Geography*, an ancient town of France, in the department of Landes, formerly Gascony, containing 3000 inhabitants. It is seated on the river Adour, on the declivity of a mountain, 155 leagues from Paris. W. Long. 0. 12. N. Lat. 43. 42.

AIRE, a strong town in the Netherlands, in the county of Artois, now the department of Pas de Calais, with a castle. It is seated on the river Lis, 22 miles south of Dunkirk, and communicates with St Omer's by a canal cut from the river Aa. E. Long. 2. 31. N. Lat. 50. 38.

AIRING, a term peculiarly used for the exercising horses in the open air. It purifies the blood; purges the body from gross humours; and, as the jockies express it, teaches the horse how to make the wind rake equally, and keep time with the other motions of his body. It also sharpens the stomach, and keeps the creature hungry; which is a thing of great consequence, as hunters and racers are very apt to have their stomach fall off, either from want of exercise, or from the too violent exercise which they are often exposed to. If the horse be over fat, it is best to air him before sunrise and after sunset; and in general, it is allowed by all, that nothing is more beneficial to those creatures than early and late airings. Some of our modern managers, however dispute this; they say, that the cold of these times is too great for the creature; and that if, in particular, he is subject to catarrhs, rheums, or the like complaints, the dews and cold fogs, in these early and late airings, will be apt to increase all those disorders. Nature, we see, also points out the sun-beams as of great use to these animals; those which are kept hardy and lie out all night, always running to those places where the sunshine comes, as soon as it appears in a morning. This should seem to recommend those airings that are to be made before sunset, and a little time after sunrise. As to the caution, so earnestly inculcated by Markham, of using these early and late airings for fat horses, it is found unnecessary by many: for they say, that the same effect may be produced by airings at warmer times, provided only that they are made longer; and that, in general, it is from long airings that we are to expect to bring a horse to a perfect wind and sound courage.

AIRS, in the *Manege*, are the artificial motions of taught horses; as the demivolt, curvet, capriole, &c.

AIRY, or AERY, among *Sportsmen*, a term expressing the nest of a hawk or eagle.

AIRY *Triplicity*, among *Astrologers*, denotes the three signs, Gemini, Libra, and Aquarius.

AISNE, a department in the north of France, taking its name from the river Aisne which flows through it. The surface is uneven, but not hilly; and it produces corn of all kinds, excellent flax, legumes, and wine of a pretty good quality. There are manufactures of woollens, linens, yarn, leather, &c.; but the most considerable are those of cambric and lawn. Its extent is 379 square leagues, or 749,183 hectares; and the population in 1817 was 432,989. Laon is the chief town.

AITOCZU, a considerable river of Lesser Asia, which rises in Mount Taurus, and falls into the south part of the Euxine sea.

Aiton
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Ains.

AITON, WILLIAM, an eminent botanist and gardener, was born at a village near Hamilton in Scotland, in 1731. Having been regularly trained to the profession of a gardener, he came into England in the year 1754, and soon obtained the notice of the celebrated Philip Miller, then superintendent of the physic-garden at Chelsea, who engaged him as an assistant. His industry and abilities recommended him to the princess-dowager of Wales as a fit person to manage the botanical garden at Kew. In 1759, he was appointed to this office, in which he continued during life, and which was the source of his fame and fortune. The garden at Kew, under the auspices of his present Majesty, was destined to be the grand repository of all the vegetable riches which could be accumulated, by regal munificence, from researches through every quarter of the globe. These treasures were fortunately committed to the hands of Mr Aiton, whose care and skill in their cultivation, and intelligence in their arrangement, acquired him high reputation among the lovers of the science, and the particular esteem of his royal patrons. Under his superintendence, many improvements took place in the plan and edifices of Kew-gardens, which rendered them the principal scene of botanical culture in the kingdom. In 1783, his merit was properly rewarded with the lucrative office of managing the pleasure and kitchen-gardens of Kew, which he was allowed to retain with the botanical department. In 1789, he published his *Hortus Kewensis*; or a Catalogue of the Plants cultivated in the Royal Botanic Garden at Kew, in three vols. 8vo. with 13 plates; a work which had been the labour of many years. The number of species contained in this work amounted to between five and six thousand, many of which had not before been described. A new and curious article in it relates to the first introduction of particular exotics into the English gardens. The system of arrangement adopted is the Linnæan, with improvements, which the advanced state of botanical science required. Mr Aiton with candour and modesty acknowledges the assistance he received in this work from the two eminent Swedish naturalists, Dr Solander and Mr Jonas Dryander. Indeed his character was such as secured him the friendship and good offices of the most distinguished names in science of his time. He was for many years peculiarly honoured by the notice of Sir Joseph Banks, the president of the Royal Society. The *Hortus Kewensis* was received with avidity by the botanic world, and a large impression was soon disposed of.

Notwithstanding the singular activity and temperance of Mr Aiton, he fell into that incurable malady, a schirrous liver, of which he died in 1793, in his sixty-second year. His eldest son, devoted to the same pursuits, was, by the king's own nomination, appointed to all his father's employments. Mr Aiton's private character was highly estimable for mildness, benevolence, piety, and every domestic and social virtue. He was interred in the churchyard of Kew, amidst a most respectable concourse of friends. (*Gen. Biog.*)

AITONIA, in *Botany*. See *BOTANY Index*.

AJUGA, BUGLE, in *Botany*. See *BOTANY Index*.

AIUS LOCUTUS, the name of a deity to whom the Romans erected an altar. The words are Latin, and signify "a speaking voice." The following accident gave

Aix.
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Aix.

gave occasion to the Romans erecting an altar to Aius Locutius. One M. Seditius, a plebeian, acquainted the tribunes, that, in walking the streets by night, he had heard a voice over the temple of Vesta, giving the Romans notice that the Gauls were coming against them. The intimation was, however, neglected; but after the truth was confirmed by the event, Camillus acknowledged this voice to be a new deity, and erected an altar to it under the name of *Aius Locutius*.

AJUTAGE, or ADJUTAGE, a kind of tube fitted to the mouth of the vessel through which the water of a fountain is to be played. To the different form and structure of ajutages is owing the great variety of fountains.

AIX, a small but ancient town in the duchy of Savoy, with the title of a marquise. It is seated on the lake Bourget, at the foot of a mountain, between Chamberry, Annecy, and Rumilly. There is here a triumphal arch of the ancient Romans, but it is almost entirely ruined. The mineral waters bring a great number of strangers to this place. The place was originally called *Aquæ Gratianæ*, from the hot baths built there by the emperor Gratian. E. Long. 5. 48. N. Lat. 45. 40.

AIX, in *Geography*, an ancient city in the department of the Bouches du Rhone, formerly capital of Provence, in France. This city has an air of silence and gloom commonly characteristic of places destitute of commerce or industry. It is, however, well-built; and most like Paris of any place in the kingdom, as well for the largeness of the buildings as in respect of the politeness of the inhabitants. The population in 1817 was 27,000. It is embellished with abundance of fine fountains, and several beautiful squares. The Preachers square is on the side of a hill; it is about 160 yards in length, and is surrounded with trees, and houses built with stone three stories high. The town-hall is at one end of the city, and is distributed into several fine apartments, formerly occupied by the parliament and other public bodies. The hotel of the city is a handsome building, but hid by the houses of the narrow street in which it is placed. The cathedral church is a Gothic structure, with tombs of several earls of Provence, and some good pictures by French masters. The Corse, or Orbitelle, is a magnificent walk, above 300 yards long, formed by a triple avenue of elms, and two rows of regular and stately houses. Before the revolution, there was a great number of religious houses here. It has manufactures of velvet, and other silk stuffs, and some trade in oil, wine, brandy, wool, grain, silk, figs, raisins, &c. There are other churches and buildings which contain a great number of rarities. The baths without the city, which were discovered not long since, have good buildings, raised at a vast expence, for the accommodation of those who drink the waters. Although Aix was the first Roman settlement in Gaul, it is not remarkable for ancient remains. The warm springs, from which it is now known and frequented, induced Sextus Calvinus to found a colony here, to which he gave the name of *Aquæ Sextiæ*. The waters are clear and light, and without taste or smell. They were supposed to possess particular virtues in cases of debility; and several altars have been dug up sacred to Priapus,

the inscriptions on which indicate their gratitude to that deity for his supposed succour and assistance. E. Long. 5. 32. N. Lat. 43. 32.

AIX, a small island on the coast of France, between the isle of Oleron and the continent. It is 12 miles north-west of Rochfort, and 11 south-south-west of Rochelle. W. Long. 1. 4. N. Lat. 46. 5.

AIX-LA-CHAPELLE, a fine city of Germany, in the circle of Westphalia and duchy of Juliers, and capital of the department of Roer.

All authors are agreed about its antiquity, it being mentioned in Cæsar's Commentaries and the Annals of Tacitus. The Romans had colonies and fortresses there, when they were at war with the Germans; but the mineral waters and the hot bath so increased its fame, that, in process of time, it was advanced to the privileges of a city, by the name of *Aquægranii*, that is, the waters of Granus; that which it has now, of *Aix-la-Chapelle*, was given it by the French, to distinguish it from the other Aix. It is so called, on account of a chapel built in honour of the Holy Virgin by Charlemagne; who having repaired, beautified, and enlarged the city, which was destroyed by the Huns in the reign of Attila in 451, made it the usual place of his residence. The town is seated in a valley surrounded with mountains and woods, and yet the air is very wholesome. It may be divided into the inward and outward city; which together contained 27,164 inhabitants in 1807. The inward is encompassed with a wall about three quarters of a league in circumference, having ten gates; and the outward wall, in which there are eleven gates, is about a league and a half in circumference. There are rivulets which run through the town and keep it very clean, turning several mills; besides 20 public fountains, and many private ones. They have stone quarries in the neighbourhood, which furnish the inhabitants with proper materials for their magnificent buildings, of which the stadt-house and the cathedral are the chief. There are likewise 30 parochial or collegiate churches. The market-place is very spacious, and the houses round it are stately. In the middle, before the stadt-house, is a fountain of blue stones, which throws out water, from six pipes, into a marble bason placed beneath, 30 feet in circumference. On the top of this fountain is placed the statue of Charlemagne, of gilt brass, holding a sceptre in his right hand, and a globe in his left. The stadt-house is adorned with the statues of all the emperors since Charlemagne. This fabric has three stories, the upper of which is one entire room of 160 feet in length and 60 in breadth. In this the new-elected emperor formerly entertained all the electors of the empire.

Aix-la-Chapelle was formerly a free imperial city, but was taken possession of by the French in 1794, in whose power it remained till 1815, when it was transferred to Prussia. This place is famous for several councils and treaties of peace concluded here; particularly those between France and Spain in 1668, and between Great Britain and France in 1748.

The hot sulphureous waters for which this place has so long been celebrated, arise from several sources, which supply eight baths constructed in different parts of the town. These waters near the sources are clear and

Aix.
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Chapelle.

Aix-la-Chapelle.

and pellucid: and have a strong sulphureous smell, resembling the washings of a foul gun; but they lose this smell by exposure to air. Their taste is saline, bitter, and urinous. They do not contain iron. They are also neutral near the fountain, but afterwards are manifestly and pretty strongly alkaline, insomuch that clothes are washed with them without soap. On the vaults above the springs and aqueducts of these waters is found, every year, when they are opened, a quantity of fine white-coloured flowers of sulphur, which has been sublimed from the waters.

The heat of the water of the hottest spring, by Dr Lucas's account, raised the quicksilver of Fahrenheit's thermometer to 136°—by Mons. Monet's account, to 146°—and the heat of the fountain, where they commonly drink, by Dr Lucas's account, to 112°

Dr Simmons has given the following account of their several temperatures, as repeatedly observed by himself with a thermometer constructed by Nairne.

The spring which supplies the Emperor's Bath (*Bain de l'Empereur*), the New Bath (*Bain Neuf*), and the Queen of Hungary's Bath (*Bain de la Reine de Hongrie*), 127°

St Quirin's Bath (*Bain de St Quirin*), 112°

The Rose Bath (*Bain de la Rose*), and the Poor's Bath (*Bain des Pauvres*), both of which are supplied by the same spring, 112°

Charles's Bath (*Bain de Charles*), and St Cornelle's Bath (*Bain de St Cornelle*), 112°

The spring used for drinking is in the High Street, opposite to Charles's Bath; the heat of it at the pump is 106°

Dr Lucas evaporated the water of the hottest spring (of the Emperor's Bath), and obtained 268 grains of solid matter from a gallon, composed of 15 grains of calcareous earth, 10 grains of selenites, and 243 grains of a saline matter made of natron and sea-salt. They are at first nauseous and harsh, but by habit become familiar and agreeable. At first drinking also they generally affect the head. Their general operation is by stool and urine, without griping or diminution of strength; and they also promote perspiration.

The quantity to be drank as an alterative is to be varied according to the constitution and other circumstances of the patient. In general, it is best to begin with a quarter or half a pint in the morning, and increase the dose afterwards to a pint, as may be found convenient. The water is best drank at the fountain. When it is required to purge, it should be drank in large and often repeated draughts.

In regard to bathing, this also must be determined by the age, sex, strength, &c. of the patient, and by the season. The degree of heat of the bath should likewise be considered. The tepid ones are in general the best, though there are some cases in which the hotter ones are most proper. But, even in these, it is best to begin with the temperate baths, and increase the heat gradually.

These waters are efficacious in diseases proceeding from indigestion and from foulness of the stomach and bowels; in rheumatisms; in the scurvy, scrophula, and diseases of the skin; in hysteric and hypochondriacal disorders; in nervous complaints and melancholy; in the stone and gravel; in paralytic complaints; in those evils which follow an injudicious use of mercury; and in

many other cases. They ought not, however, to be given in hectic cases where there is heat and fever, in putrid disorders, or where the blood is dissolved or the constitution much broken down.

The time of drinking, in the first season, is from the beginning of May to the middle of June; and, in the latter season, from the middle of August to the latter end of September.

There are galleries or piazzas under which the company walk during the time of drinking, in order to promote the operation of the waters.—The Poor's Bath is free for every body, and is frequented by crowds of poor people.

It is scarcely necessary to add, that there are all kinds of amusements common to other places of public resort; but the sharpeners appear more splendid here than elsewhere, assuming titles, with an equipage suitable to them. A congress was held here in 1818, by the sovereigns who kept an army in France after the late peace. Aix-la-Chapelle is 21 miles from Spa, 36 from Liege, and 30 from Cologne. E. Long. 5. 48. N. Lat. 51. 55.

AIZOON, in *Botany*. See BOTANY Index.

AKENSIDE, MARK, a physician, who published in Latin "A Treatise upon the Dysentery," in 1764, and a few pieces in the first volume of the "Medical Transactions" of the college of physicians, printed in 1768; but far better known, and to be distinguished chiefly hereafter, as a poet. He was born at Newcastle-upon-Tyne, November 9. 1721; and after being educated at the grammar-school in Newcastle, was sent to the universities of Edinburgh and Leyden; at which last he took his degree of doctor in physic. He was afterwards admitted by mandamus to the same degree at Cambridge; elected a fellow of the college of physicians, and one of the physicians at St Thomas's Hospital; and, upon the establishment of the queen's household, appointed one of the physicians to her Majesty.

That Dr Akenside was able to acquire no other kind of celebrity than that of a scholar and a poet, is to be accounted for by the following particulars in his life and conduct, related by Sir John Hawkins.—Mr Dyson and he were fellow-students, the one of law and the other of physic, at Leyden; where, being of congenial tempers, a friendship commenced between them that lasted through their lives. They left the university at the same time, and both settled at London: Mr Dyson took to the bar, and being possessed of a handsome fortune, supported his friend while he was endeavouring to make himself known as a physician; but in a short time, having purchased of Mr Hardinge his place of clerk of the house of commons, he quitted Westminster-hall; and for the purpose of introducing Akenside to acquaintance in an opulent neighbourhood near the town, bought a house at North-End, Hampstead; where they dwelt together during the summer season, frequenting the long-room, and all clubs and assemblies of the inhabitants.

At these meetings, which, as they were not select, must be supposed to have consisted of such persons as usually meet for the purpose of gossiping, men of wealth, but of ordinary endowments, and able to talk of little else than news and the occurrences of the day, Akenside was for displaying those talents which had acquired him the reputation he enjoyed in other com-

Aix-la-Chapelle
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Akenside.

Akenside. panies: but here they were of little use to him; on the contrary, they tended to engage him in disputes that betrayed him into a contempt of those that differed in opinion from him. It was found out that he was a man of low birth, and a dependent on Mr Dyson; circumstances that furnished those whom he offended with a ground of reproach, which reduced him to the necessity of asserting in terms that he was a gentleman.

Little could be done at Hampstead after matters had proceeded to this extremity: Mr Dyson parted with his villa at North-End, and settled his friend in a small house in Bloomsbury-square; assigning for his support such a part of his income as enabled him to keep a chariot.—In this new situation Akenside used every endeavour to become popular, but defeated them all by the high opinion he everywhere manifested of himself, and the little condescension he showed to men of inferior endowments; by his love of political controversy, his authoritative censure of the public councils, and his peculiar notions respecting government. In the winter evenings he frequented Tom's coffee-house in Devereux-court, then the resort of some of the most eminent men for learning and ingenuity of the time; with some of whom he was involved in disputes and altercations, chiefly on subjects of literature and politics, which fixed on his character the stamp of haughtiness and self-conceit. Hence many, who admired him for his genius and parts, were shy of his acquaintance.

The value of that precept which exhorts us to live peaceably with all men, or, in other words, to avoid creating enemies, can only be estimated by the reflection on those many amiable qualities against which the neglect of it will preponderate. Akenside was a man of religion and strict virtue; a philosopher, a scholar, and a fine poet. His conversation was of the most delightful kind; learned, instructive, and, without any affectation of wit, cheerful and entertaining.

Dr Akenside died of a putrid fever, June 23. 1770; and is buried in the parish-church of St James's Westminster.

His poems, published soon after his death in 4to and 8vo, consist of "The Pleasures of Imagination," two books of "Odes," a "Hymn to the Naiads," and some "Inscriptions." "The Pleasures of Imagination," his capital work, was first published in 1744; and a very extraordinary production it was from a man who had not reached his 23d year. He was afterwards sensible, however, that it wanted revision and correction; and he went on revising and correcting it for several years; but finding this task to grow upon his hands, and despairing of ever executing it to his own satisfaction, he abandoned the purpose of correcting, and resolved to write the poem over anew upon a somewhat different and enlarged plan. He finished two books of his new poem, a few copies of which were printed for the use of the author and certain friends; of the first book in 1757, of the second in 1765. He finished also a good part of a third book, and an introduction to a fourth; but his most munificent and excellent friend, conceiving all that is executed of the new work too inconsiderable to supply the place, and superseding the republication, of the original poem, and yet too valuable to be withheld from the public, hath caused them both to be inserted in the collection of his poems.

AKIBA, a famous rabbin, flourished a little after the destruction of Jerusalem by Titus. He kept the flocks of a rich citizen of Jerusalem till the 40th year of his age, and then devoted himself to study in the academies for 24 years; and was afterwards one of the greatest masters in Israel. According to the Jewish accounts, he had 24,000 scholars. He declared for the impostor Barcochebas, whom he owned for the Messiah; and not only anointed him king, but took upon himself the office of his master of the horse. The troops which the emperor Hadrian sent against the Jews, who under the conduct of this false Messiah had committed horrid massacres, exterminated this faction. Akiba was taken, and put to death with great cruelty. He lived 120 years; and was buried with his wife in a cave upon a mountain not far from Tiberias, and his 24,000 scholars were buried round about him upon the same mountain. It is imagined he invented a supposititious work under the name of the patriarch Abraham.

AKISSAT, the ancient Thyatira, a city of Natolia, in Asia, situated in a plain 18 miles broad, which produces plenty of cotton and grain. The inhabitants, who are reckoned to be about 5000, are said to be all Mahometans. The houses are built of nothing but earth or turf dried in the sun, and are very low and ill contrived; but there are six or seven mosques, which are all of marble. There are remarkable inscriptions on marble in several parts of the town, which are part of the ruins of the ancient Thyatira. It is seated on the river Hermus, 50 miles from Pergamos. E. Long. 28. 30. N. Lat. 38. 50.

AKOND, an officer of justice in Persia, who takes cognizance of the causes of orphans and widows; of contracts, and other civil concerns. He is the head of the school of law, and gives lectures to all the subaltern officers: he has his deputies in all the courts of the kingdom, who, with the second *sadra*, make all contracts.

AL, an Arabic particle prefixed to words, and signifying much the same with the English particle *the*: Thus they say, alkermes, alkoran, &c. i. e. the kermes, the koran, &c.

AL, or **ALD**, a Saxon term frequently prefixed to the names of places, denoting their antiquity; as Aldborough, Aldgate, &c.

ALA, a Latin term, properly signifying a wing; from a resemblance to which several other things are called by the same name: Thus,

ALA, is a term used by botanists for the hollow of a stalk, which either the leaf, or the pedicle of the leaf, makes with it; or it is that hollow turning, or sinus, placed between the stalk or branch of a plant and the leaf, whence a new offspring usually issues. Sometimes it is used for those parts of leaves otherwise called *lobes*, or *wings*.

ALÆ (the plural number) is used to signify those petals or leaves of papilionaceous flowers, placed between those others which are called the *vexillum* and *carina*, and which make the top and bottom of the flowers. Instances of flowers of this structure are seen in those of pease and beans, in which the top leaf or petal is the vexillum, the bottom the carina, and the side ones the alæ.

ALÆ is also used for those extremely slender and membranaceous

Akiba
Alc.

Also
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alabaster.

membranaceous parts of some seeds, which appear as wings placed on them; it likewise signifies those membranaceous expansions running along the stems of some plants, which are therefore called *alated stalks*.

ALÆ, in *Anatomy*, a term applied to the lobes of the liver, the cartilages of the nostrils, &c.

ALÆ, in the *Roman Art of War*, were the two wings or extreme parts of the army drawn up in order of battle.

ALABA, one of the three smallest districts of Biscay in Spain, but pretty fertile in rye, barley, and fruits. There are in it very good mines of iron, and it had formerly the title of a kingdom.

ALABANDA, in *Ancient Geography*, a town of Caria, near the Meander, situated beneath eminences resembling asses with pack-saddles, which gave rise to the jest; and between Amyzo to the west and Stratonice to the east. Under the Romans they enjoyed assizes, or a convention of jurisdiction, by Pliny reckoned the fourth in order; hence the proverb in Stephanus, expressing their happiness. It was built by Alabandus, whom therefore they deemed a god. The people were called *Alabandi*, *Alabandenses*, (Cicero;) and *Alabandeis*, after the Greek manner, in coins of Augustus and Claudius; they were also called *Alabandeni* (Livy).

ALABARCHA, in *Antiquity*, a kind of magistrate among the Jews of Alexandria, whom the emperors allowed them to elect, for the superintendency of their policy, and to decide differences and disputes which arose among them.

ALABASTER, WILLIAM, an English divine, was born at Hadley in the county of Suffolk. He was one of the doctors of Trinity college in Cambridge; and he attended the earl of Essex as his chaplain in the expedition to Cadiz in the reign of Queen Elizabeth. It is said, that his first resolutions of changing his religion were occasioned by his seeing the pomp of the churches of the Roman communion, and the respect with which the priests seemed to be treated amongst them; and appearing thus to waver in his mind, he soon found persons who took advantage of this disposition of his, and of the complaints which he made of not being advanced according to his deserts in England, in such a manner, that he did not scruple to go over to the Popish religion, as soon as he found that there was no ground to hope for greater encouragement in his own country. However that matter be, he joined himself to the Romish communion, but was disappointed in his expectations. He was soon displeased at this; and he could not reconcile himself to the discipline of that church, which made no consideration of the degrees which he had taken before. It is probable too that he could not approve of the worship of creatures, which Protestants are used to look upon with horror. Upon this he returned to England in order to resume his former religion. He obtained a prebend in the cathedral of St Paul, and after that the rectory of Therfield in Hertfordshire. He was well skilled in the Hebrew tongue; but he gave a wrong turn to his genius by studying the Cabala, with which he was strangely infatuated. He gave a proof of this in a sermon which he preached upon taking his degree of doctor of divinity at Cambridge. He took for his text the beginning of the first book of Chronicles, "Adam, Seth, Enos;" and having touched upon the literal sense, he

Alabaster
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Aladulia.

turned immediately to the mystical, asserting, that Adam signified misfortune and misery, and so of the rest. His verses were greatly esteemed. He wrote a Latin tragedy intitled *Roxana*; which, when it was acted in a college at Cambridge, was attended with a very remarkable accident. There was a lady who was so terrified at the last word of the tragedy, *Sequar, Sequar*, which was pronounced with a very shocking tone, that she lost her senses all her lifetime after. He died in the year 1640. His *Apparatus in Revelationem Jesu Christi* was printed at Antwerp in 1607. His *Spiraculum tubarum, seu fons Spirituum Expositionum ex æquivocis Pentaglotti significationibus*, and his *Ecce Sponsus venit, seu tuba pulchritudinis, hoc est demonstratio quod non sit illicitum nec impossibile computare durationem mundi et tempus secundi adventus Christi*, were printed at London. From these titles we may judge what were the taste and genius of the author.

ALABASTER, in *Natural History*, a mineral substance whose base is calcareous earth. It differs from marble in being combined, not with the carbonic, but with the sulphuric acid. See CHEMISTRY, and MINERALOGY Index.

ALABASTER, in *Antiquity*, a term used for a vase wherein odoriferous liquors were anciently put. The reason of the denomination is, that vessels for this purpose were frequently made of the alabaster stone, which Pliny and other ancients represent as peculiarly proper for this purpose. Several critics will have the box mentioned in the Gospels as made of alabaster to have been of glass: And though the texts say that the woman broke it, yet the pieces seem miraculously to have been united, since we are told the entire box was purchased by the emperor Constantine, and preserved as a relic of great price. Others will have it, that the name *alabaster* denotes the form rather than the matter of this box: In this view they define alabaster by a box without a handle, deriving the word from the privative α, and λαβη, *ansa*, handle.

ALABASTER is also said to have been used for an ancient liquid measure, containing ten ounces of wine, or nine of oil. In this sense, the alabaster was equal to half the sextary.

ALABASTRUM DENDROIDE, a kind of laminated alabaster, beautifully variegated with the figures of shrubs, trees, &c. found in great abundance in the province of Hohenstein.

ALADINISTS, a sect among the Mahometans, answering to freethinkers among us.

ALADULIA, a considerable province of Turkey in Asia, in that part called Natolia, between the mountains of Antitaurus, which separate it from Amasia on the north, and from Carimania on the west. It has the Mediterranean sea on the south; and the Euphrates, or Frat, on the east, which divides it from Diarbeker. It comprehends the Lesser Armenia of the ancients, and the east part of Cilicia. Formerly it had kings of its own; but the head of the last king was cut off by Selim I. emperor of the Turks, who had conquered the country. It is now divided into two parts: the north, comprehended between Taurus, Antitaurus, and the Euphrates, is a beglerbeglic, which bears the name of Marash, the capital town; and the south, seated between Mount Taurus and the Mediterranean, is united to the beglerbeglic of Aleppo. The country is rough,

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rugged, and mountainous; yet there are good pastures, and plenty of horses and camels. The people are hardy and thievish. The capital is Malatigah.

ALAIN, CHARTIER, secretary to Charles VII. king of France, born in the year 1386. He was the author of several works in prose and verse; but his most famous performance was his Chronicle of King Charles VII. Bernard de Girard, in his preface to the History of France, styles him "an excellent historian, who has given an account of all the affairs, particulars, ceremonies, speeches, answers, and circumstances, at which he was present himself, or had information of." Giles Coroxet tells us, that Margaret, daughter to the king of Scotland, and wife to the dauphin, passing once through a hall where Alain lay asleep, she stopped and kissed him before all the company who attended: some of them telling her, that it was strange she should kiss a man who had so few charms in his person, she replied, "I did not kiss the man, but the mouth from whence proceed so many excellent sayings, so many wise discourses, and so many elegant expressions." Mr Fontenelle, among his Dialogues of the Dead, has one upon this incident, between the princess Margaret and Plato. Mr Pasquier compares Alain to Seneca, on account of the great number of beautiful sentences interspersed throughout his writings.

ALAIS, a considerable town of France, in the department of Gard, and formerly the province of Languedoc, situated on the river Gard, at the foot of the Cevennes. The Jesuits had a college in this place; and a fort was built here in 1689. It is 34 miles north of Montpellier, and 340 from Paris. E. Long. 4. 20. N. Lat. 44. 8. Population 7802 in 1815.

ALAMAGAN, in *Geography*, one of the Ladrone or Marianne islands, in the Indian ocean, is situated in N. Lat. 18. 5. and E. Long. 146. 47. It is of an irregular form, and about 12 miles in circumference. The land in some places of this island is pretty high, so that it may be seen at the distance of 12 or 14 leagues. Near the north end of the island there is a volcano which emitted an immense body of smoke in the year 1799, when it was visited by Captain Bass. The volcano is in a mountain close to the sea, rising above its level 1200 or 1500 feet. The high parts of the island are rugged and sterile. In the lower parts there is a profusion and luxuriance of vegetation. They abound with cocoa-nut trees, several kinds of stone fruit, and the mellora or bread-tree of the Nicobar islands. Some small sugar canes, some banana trees, and one bread-fruit tree, were discovered. Lizards, land-crabs, large partridges, quails, pigeons, owls, thrushes, and bullfinches, are numerous. But no fresh water, which was the object of Captain Bass's visit, could be found.

ALAMANDUS, LEWIS, in French *Aleman*, archbishop of Arles, and cardinal of St Cecilia, was one of the greatest men of the 15th century. The cardinal presided in the council of Basil, which deposed Eugenius IV. and elected the antipope Felix V. He is much commended by Æneas Sylvius, as a man extremely well formed for presiding in such assemblies, firm and vigorous, illustrious by his virtue, learned, and of an admirable memory in recapitulating all that the orators and disputants had said. One day, when he harangued against the superiority of the pope over the

council, he distinguished himself in such an eminent manner, that several persons went to kiss him, while others pressed even to kiss his robe. They extolled to the skies his abilities and genius, which had raised him, though a Frenchman, to a superiority over the Italians, notwithstanding all their natural subtlety and finesse. There is no need of asking, whether Pope Eugenius thundered against the president of a council which deposed him. He deprived him of all his dignities, and treated him as a son of iniquity. However, notwithstanding this, Lewis Alamandus died in the odour of sanctity, and performed so many miracles after his death, that at the request of the canons and Celestine monks of Avignon, and the solicitation of the cardinal of Clermont, legate *à latere* of Clement VII. he was beatified by the pope in the year 1527.

ALAMANNI, LEWIS, was born at Florence, of a noble family, on the 28th of October 1495. He was obliged to fly his country for a conspiracy against Julius de Medici, who was soon after chosen pope under the name of Clement VII. During this voluntary banishment, he went into France: where Francis I. from a love to his genius and merit, became his patron. This prince employed him in several important affairs, and honoured him with the collar of the order of St Michael. About the year 1540, he was admitted a member of the *Inflammati*, an academy newly erected at Padua, chiefly by Daniel Barbaro and Ugolin Martelli. After the death of Francis, Henry duke of Orleans, who succeeded him in 1537, showed no less favour to Alamanni; and in the year 1551, sent him as his ambassador to Genoa: this was his last journey to Italy; and being returned to France, he died at Amboise on the 18th of April 1556, being in the 61st year of his age. He left many beautiful poems, and other valuable performances, in the Italian language. We have also some notes of his upon Homer's *Iliad* and *Odyssey*: those upon the *Iliad* were printed in the Cambridge edition of Homer in 1689, and Joshua Barnes has also inserted them in his fine edition of Homer in 1711.

ALAMODALITY, in a general sense, is the accommodating a person's behaviour, dress, and actions, to the prevailing taste of the country or times in which he lives.

ALAMODALITY of writing, is defined the accommodation of mental productions, both as to the choice of subject and the manner of treating it, to the genius or taste of the times, in order to render them more acceptable to the readers.

ALAMODE, a phrase originally French, importing a thing to be in the fashion or mode. The phrase has been adopted not only into several of the living languages, as the English and High Dutch, but some have even taken it into the Latin. Hence we meet with *Alamodicus* and *Alamodalitas*.

ALAMODE, in *Commerce*, a thin glossy black silk, chiefly used for women's hoods and men's mourning scarfs.

ALAMOS, BALTHASAR, a Spanish writer, born at Medina del Campo in Castile. After having studied the law at Salamanca, he entered into the service of Anthony Perez, secretary of state under Philip II. He was in high esteem and confidence with his master, upon which account he was imprisoned after the disgrace

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Aland.

of this minister. He was kept in confinement 11 years, when Philip III. coming to the throne, set him at liberty, according to the orders given by his father in his will. Alamos continued in a private capacity, till the duke of Olivarez, the favourite of Philip IV. called him to public employments. He was a man of wit as well as judgment, but his pen was superior to his tongue. He died in the 88th year of his age. His Spanish translation of Tacitus, and the aphorisms which he added in the margin, gained him great reputation. This work was published at Madrid in 1614; and was to have been followed, as mentioned in the king's privilege, with a commentary, which, however, has never yet appeared. The author composed the whole during his imprisonment.

ALAN, CARDINAL WILLIAM, was born at Rossall in Lancashire, in the year 1532. He went to Oxford at the age of 15, and in 1550 was elected fellow of Oriel college. In 1556, being then only 24 years old, he was chosen principal of St Mary's hall, and one of the proctors of the university. In 1558 he was made canon of York; but, upon Queen Elizabeth's accession to the throne, he left England, and settled at Louvain in an English college, of which he became the chief support. In 1565 he visited his native country; but on account of his extreme activity in the propagation of the Roman Catholic religion, he was obliged to fly the kingdom in 1568. He went first to Mechlin, and then to Douay, where he was made doctor of divinity. Soon after, he was appointed canon of Cambray, and then canon of Rheims. He was created cardinal on the 28th of July 1587, by the title of *St Martin in Montibus*; and obtained from the king of Spain a rich abbey in the kingdom of Naples, and afterwards the bishoprick of Mechlin. It is supposed to have been by the advice and instigation of this priest, that Philip II. attempted to invade England. He died on the 20th of October 1594, aged 63; and was buried in the English college at Rome. He was a man of considerable learning, and an elegant writer. He wrote many books in defence of the Romish religion. The most remarkable are, 1. *A defence of the 12 Martyrs in one Year*. Tho. Alfield was hanged for bringing, and publishing, this and other of Alan's works, into England, in the year 1584. 2. *A Declaration of the Sentence of Sixtus V. &c.* A work intended to explain the pope's bull for the excommunication of Queen Elizabeth, and to exhort the people of England to take up arms in favour of the Spaniards. Many thousand copies of this book, printed at Antwerp, were put on board the Armada; but the enterprise failing, they were afterwards destroyed. 3. *Of the Worship due to Saints and their Relicks*, 1583. This treatise was answered by Lord Burleigh, and is esteemed the most elegant of the cardinal's writings.

ALAND, in *Geography*, with its dependant islands, to the number of eighty, is situated between the gulfs of Bothnia and Finland. These islands lie between N. Lat. 59. 47. and 60. 30. and between E. Long. 19. 17. and 22. 7. It contains about seventy-seven square English miles, and is in length about twenty English miles, and sixteen in breadth. It formed part of the possessions of Sweden, but was ceded to Russia along with Finland in 1809.

Aland has been supposed anciently to have been

governed by its own monarchs; it is certain, however, that since the fourteenth century, it has made part of the bishoprick and government of Abo, with the exception that in the year 1743 Aland and the other islands submitted to Russia, and swore allegiance to the czarina, but were soon after restored to Sweden by the treaty of Abo. These islands in former times frequently suffered from the invasions of the Russians, and the inhabitants had been forced to fly from their houses and fertile plains. But in 1718 a congress was held here for the restoration of peace, by which the enjoyment of tranquillity was secured to them.

Aland and the several isles contain eight parishes, each of which has a church; and besides these places of worship, there are seven chapels.

The Laplanders and Fins were undoubtedly the earliest inhabitants of these islands, and their residence here is plainly to be traced in the names of places which still remain.

Several lakes are met with in these islands, and but one rivulet, which however is sufficient to work two mills, one of which is a saw-mill. The mountains are numerous; the highest of them is called Ulfdubs Klint.

The revenues which the crown of Sweden receives from Aland and the other islands, amount annually to nineteen thousand nine hundred and eighty-six rix-dollars. Two hundred and ninety-eight sailors are registered in these islands, which cost the king of Sweden about five thousand rix-dollars yearly.

Aland contains about three thousand seven hundred and fifty acres of land in cultivation, which produce rye, wheat, oats, and barley, in the proportion of seven for one. The annual growth of wheat is about twenty-two thousand five hundred barrels. There is one parish which has no arable land, and in this respect resembles Lapland. The inhabitants of this parish employ themselves in fishing, and purchase all the corn they have occasion for of their neighbours. They catch vast numbers of pilchards, of which they make great profit, it being the chief traffic of these islands.

It has been in agitation to build a city in the isle of Aland, but the project has not hitherto been carried into execution, owing, it is said, to the difficulty of chusing a proper spot for it.

The usual route from Sweden to Finland is from the post-office of Grislehamn in Upland, which is eleven and a half Swedish miles, to Eckero in Aland; and from that place across the island to Abo, which is five miles more. A Swedish mile makes between six and seven English miles.

In the year 1792 the number of inhabitants upon the island of Aland amounted to eleven thousand two hundred and sixty, which is upwards of a thousand to every square Swedish mile; a very great number when it is considered how mountainous the island is. The inhabitants of these islands live to very great ages. From the year 1692 to the present time, nine persons are recorded to have died at the great age of one hundred years; and perhaps the number had been found greater, had it been thought worth while to notice this particular. In 1703 there died a woman named Anna Berg, who was one hundred and nine years old: and at Kumblinge, in the year 1766, another person of the same sex died at an age of upwards of one hundred and twenty years. One sixth part of the inhabitants are about fifty years old;

Aland,
Alaraf.

old; a circumstance which affords a convincing proof of the healthiness of the place.

The sea which surrounds the isle of Aland is very seldom frozen, and was less so formerly than at the present time. In 1546 it was remarked as an extraordinary event, that in that year the sea was so frozen as to be crossed on the ice. It seems latterly that these severe frosts happened once in ten years. The winter of the year 1702 was remarkably mild, so that barley was sown on the twenty-fifth of March, at which time there was plenty of pasture for cattle: considering its high latitude, Aland enjoys a very favourable climate.

In their manners and customs the inhabitants of Aland do not differ greatly from the peasants of Up-land. Their marriages and funerals are celebrated much in the same manner.

The Alanders commonly use nourishing food; their bread is generally made of rye, even when the crops of that kind of corn have proved unfavourable. Fresh fish, and fish dried or salted, together with milk, butter, cheese, and flesh-meat, are their usual fare. They make use of the flesh of seals; and prepare a dish called *skalkroppe*, composed of collops of the flesh mixed up with flour and lard, and this they reckon excellent. In their voyages by sea they lay in a good stock of provisions, and at those times are not sparing of meat and butter.

The dress of the Alanders is becoming. The men wear, in general, short jackets, which on holidays are commonly of blue cloth. The young peasants commonly wear cotton stockings, and many of them have even watches. The women, when full dressed, wear a petticoat and apron of camlet, cotton, or printed linen, and sometimes of silk. Their dress in mourning is generally of black silk, with a camlet petticoat.

The dwellings of the peasants are very neat and convenient, kept in good repair, and well lighted. They are usually built of wood, fir, or deal, and covered with the bark of the birch tree, or shingles. Their out-houses are mostly thatched. As they have no running streams and water-mills, scarcely any peasant is without a wind-mill.

The Alanders are an ingenious, lively, and courteous people; and on the sea display a great degree of skill and resolution. They are far from being superstitious, but are said to be of a litigious disposition.

No bears or squirrels are to be found in these islands; and the elk, which formerly was uncommonly numerous, is now no longer seen in them. The animals chiefly found are wolves (which are said to cross the sea from Finland, when it has happened to be frozen over), foxes, martens, hares, ermines, bats, moles, rats, mice, &c.; otters are but rarely met with: on the coast are found seals, &c. Above a hundred species of birds are found in the islands. Fish are in great abundance. The number of insects amounts to eight hundred species, some of which are extremely destructive to trees and newly built houses. The mountains are chiefly formed of red granite. (*Acerbi's Travels*).

ALARAF, in the Mahometan theology, the partition wall that separates heaven from hell. The word is plural, and properly written *al araf*; in the singular it is written *al arf*. It is derived from the Arabic verb *arafa*, to distinguish. Alaraf gives the denomi-

nation to the seventh chapter of the Alcoran, wherein mention is made of this wall. Mahomet seems to have copied his Alaraf, either from the great gulf of separation mentioned in the New Testament, or from the Jewish writers, who also speak of a thin wall dividing heaven from hell. Mahometan writers differ extremely as to the persons who are to be found on Alaraf. Some take it for a sort of limbus for the patriarchs, prophets, &c.; others place here such whose good and evil works so exactly balance each other, that they deserve neither reward nor punishment. Others imagine this intermediate space to be possessed by those who, going to war without their parents leave, and suffering martyrdom there, are excluded paradise for their disobedience, yet escape hell because they are martyrs.

ALARBES, a name given to those Arabians who live in tents, and distinguish themselves by their dress from the others who live in towns.

ALARES, in Roman antiquity, an epithet given to the cavalry, on account of their being placed in the two wings of the army.

ALARIC, a famous general of the Goths. He entered Thrace at the head of 200,000 men, and laid waste all the country through which he passed. He marched next to Macedonia and Thessaly: The Thes-salians met him near the mouth of the river Peneus, and killed about 3000 of his army; nevertheless he advanced into Greece, and after having ravaged the whole country, returned to Epirus, loaded with immense spoils. After staying here five years, he resolved to turn his arms to the west. He marched through Pannonia; and, finding little resistance, entered Italy, in the consulship of Stilicho and Aurelianus, A. D. 400. After various battles and treaties, he at last took Rome by treachery, and permitted his soldiers to plunder it; this happened A. D. 400. Alaric, having laid waste a great part of Italy, intended to pass into Sicily: but a storm obliging him to land again, he besieged the city of Cosenza; and having taken it, he died there in 411, eleven years after he first entered Italy.

ALARM, in the military art, denotes either the apprehension of being suddenly attacked; or the notice thereof signified by firing a cannon, firelock, or the like. False alarms are frequently made use of, to harass the enemy, by keeping them constantly under arms. Sometimes also this method is taken to try the vigilance of the piquet-guard, and what might be expected from them in case of real danger.

ALARM-Bell, that rung upon any sudden emergency, as a fire, mutiny, or the like.

ALARM-Post, or ALARM-Place, the ground for drawing up each regiment in case of an alarm. This is otherwise called *the rendezvous*.

ALARM, in fencing, is the same with what is otherwise called an appeal or challenge.

ALASCANI, in church history, a sect of Anti-Lutherans, whose distinguishing tenet, besides their denying baptism, is said to have been this, that the words, *This is my body*, in the institution of the eucharist, are not to be understood of the bread, but of the whole action, or celebration of the supper. They are said to have taken the name from one Joannes Alasco, a Polish baron, superintendent of the church of that country in England. See the next article.

ALASCO, JOHN, a Polish nobleman of the 16th century,

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Alasco
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century, who, imbibing the reformed opinions, was expelled his country, and became preacher to a Protestant congregation at Embden; but foreseeing persecution there, came to England about the year 1551, while the reformation was carrying on under Edward the VI. The publication of the Interim driving the Protestants to such places as afforded them toleration, 380 were naturalized here, and obtained a charter of incorporation, by which they were erected into an ecclesiastical establishment, independent on the church of England. The Augustine friars church was granted them, with the revenues, for the maintenance of Alasco as superintendent, with four assistant ministers, who were to be approved by the king: and this congregation lived undisturbed until the accession of Queen Mary, when they were all sent away. They were kindly received and permitted to settle at Embden; and Alasco at last, after an absence of 20 years, by the favour of Sigismund, returned to his own country, where he died in 1560. Alasco was much esteemed by Erasmus, and the historians of his time speak greatly in his praise. We have of his writing, *De Cæna Domini liber; Epistola continens Summam controversiæ de Cæna Domini, &c.* He had some particular tenets; and his followers are called *Alascani* in church-history.

ALATAMAHA, a large river of North America, which, rising in the Apalachian mountains, runs south-east through the province of Georgia, and falls into the Atlantic ocean, below the town of Frederica.

ALATERNUS, in *Botany*, the trivial name of a species of the rhamnus. See **RHAMNUS**, **BOTANY Index**.

ALAVA, a district of Spain, about 20 miles in length, and 17 in breadth, containing very good iron mines. Victoria is the capital town.

ALAUDA, or **LARK**. See **ORNITHOLOGY Index**.

ALAUTA, a considerable river of Turkey in Europe, which, after watering the north-east part of Transylvania and part of Walachia, falls into the Danube almost opposite to Nicopolis.

ALAY, signifying in the Turkish language "The Triumph," a ceremony which accompanies the assembling together the forces of that vast empire upon the breaking out of a war. It consists of the most insipid buffoonery, and is attended with acts of the most shocking barbarity. That which took place upon occasion of the late war between the Porte and Russia is described by Baron Tott in his *Memoirs* as follows.

"It consists in a kind of masquerade, in which each trade successively presents to the spectators the mechanical exercise of its respective art. The labourer draws his plough, the weaver handles his shuttle, the joiner his plane; and these different characters, seated in cars richly ornamented, commence the procession, and precede the standard of Mahomet, when it is brought out of the seraglio to be carried to the army, in order to insure the victory to the Ottoman troops.

"This banner of the Turks, which they name *Sandjak-Cheriff*, or The Standard of the Prophet, is so revered among them, that, notwithstanding its reputation has been so often tarnished, it still retains their implicit confidence, and is the sacred signal unto which they rally. Every thing proclaims its sanctity. None but the emirs are allowed to touch it; they are its guards, and it is carried by their chief. The Mus-

sulmans alone are permitted to look upon it. If touched by other hands, it would be defiled; if seen by other eyes, profaned. In short, it is encompassed by the most barbarous fanaticism.

"A long peace had unfortunately caused the ridiculousness, and especially the danger, of this ceremony to be forgotten. The Christians imprudently crowded to see it; and the Turks, who, by the situation of their houses, could make money of their windows, began to profit by the advantage; when an emir, who preceded the banner, proclaimed with a loud voice, 'Let no infidel dare to profane with his presence the holy standard of the prophet; and let every Mussulman who perceives an unbeliever make it known under pain of reprobation.'

"From that moment no asylum was to be found; even those became informers, who, by letting out their houses, had rendered themselves accomplices in the crime. A religious fury seized on every mind, and put arms in every hand; the more atrocious the cruelty, the more was it meritorious. No regard was paid to sex or age; pregnant women, dragged by the hair, and trodden under feet by the multitude, perished in the most deplorable manner. Nothing was respected by these monsters; and under such auspices the Turks commenced the war."

ALB; or **ALBE**, in the *Romish Church*, a vestment of white linen hanging down to the feet, and answering to the surplice of the English clergy. In the ancient church, it was usual, with those newly baptized, to wear an alb, or white vestment; and hence the Sunday after Easter was called *dominica in albis*, on account of the albs worn by the baptized on Easter-day.

ALB, is also a name of a Turkish coin, otherwise called *asper*. See **ASPER**.

ALBA, in *Ancient Geography*, a town of the Marsi in Italy, situated on the north side of the Lacus Fucinus, still retaining its name. It stands upon an eminence, and is noted in Roman history for being the state prison where captive princes were shut up after being barbarously dragged through the streets of Rome at the chariot wheels of a triumphant consul. Perseus king of Macedon terminated his wretched career in this confinement, with his son, the last hope of an illustrious line of kings. Syphax the Numidian, and Bituinus king of the Avernus, were also condemned to this gaol by the particular clemency of the senate, which sometimes indulged its savage disposition by putting its captives to death.

Alba being situated in the centre of Italy, amidst difficult mountainous passes, and far from all means of escape, was esteemed a most proper place for the purpose of guarding prisoners of importance. Artificial strength was added to its natural security by fortifications, which remain to this day in a state that proves their ancient solidity. For the entertainment of the garrison, which was required in a place of such consequence, an amphitheatre was erected, of which the ruins are still valuable, as well as the foundations of a temple, and other buildings of Roman times.

Lucius Vitellius, brother to the emperor of that name, had a villa near this place, famous for the variety and excellence of its fruit trees, which he had brought from Syria. His gardens were the nurseries where several of the most delicious stone fruits, that are now so com-

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Alba
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Alban.

mon in Europe, were first cultivated and multiplied. It must have been necessary at Alba to shelter trees transplanted from Asia, and to treat them with great tenderness and care, in order to rear them to perfection: for the climate of this high region is extremely rigorous in winter; the cold season lasts long, and is accompanied with violent storms of wind and falls of snow. The lake has been often frozen entirely over.

ALBA Firma, or *Album*, in our old customs, denoted rent paid in silver, and not in corn, which was called *black mail*.

ALBA Terra, one of the numerous names for the philosopher's stone.

ALBA Regalis. See STUHL WEISSENBURG.

ALBA Helviorum, or *Albaugusta*, in *Ancient Geography*, afterwards called *Vivarium*, now *Viviers*, in the south-east of Languedoc, on the Rhone. In the lower age the inhabitants were called *Albenses*, and their city *Civitas Albensium*, in the *Notitia Galliarum*. E. Long. 4. 45. Lat. 44. 50.

ALBA Julia, in *Ancient Geography*, now *Weissenburg*, a town of Transylvania, on the river Marisus, or Marisch, to the west of Hermanstat, supposed to be called *Alba Julia*, after Julia Domna the mother of Caracalla. There are, however, several inscriptions found at or near Weissenburg, which bear COL. APUL. that is, *Colonia Apulensis*, without the least mention of *Alba Julia*, though inscribed after Caracalla's time. Add, that Ulpian, reciting the colonies of Dacia, calls this colony *Apulensis*, and neither *Alba* nor *Julia*. Whence there is a suspicion, that *Alba Julia* is a corruption of *Apulum*. It was also called *Apulum Augustum*. E. Long. 25. 0. Lat. 46. 46.

ALBA Longa, in *Ancient Geography*, a colony from Lavinum, in Latium, established by Ascanius the son of Æneas, at the foot of the Mons Albanus: called *Alba*, from a white sow found by Æneas, which farrowed 30 white pigs on that spot; which circumstance was interpreted to portend the building of a city there in 30 years after (Propertius). The epithet *Longa* was added on account of its length. It was the royal residence till the building of Rome, as was foretold by Anchises (Virgil); was destroyed by Tullus Hostilius, all but the fane or temple; and the inhabitants were transplanted to Rome (Strabo).

ALBA Pompeia, in *Ancient Geography*, on the river Ceba, now *Ceva*, in Liguria, the birth-place of the emperor Pertinax; a colony either established at first by Pompey, or re-established by him after having been before settled by Scipio. The inhabitants were called *Albenses Pompeiani*. At this day the town is simply called *Alba*, without any epithet.

ALBAHURIM, *figura sexdecim laterum*, a figure of great importance according to astrological physicians, who built their prognostics on it.

ALBAN, St. is said to have been the first person who suffered martyrdom for Christianity in Britain; he is therefore usually styled the protomartyr of this island. He was born at Verulam, and flourished towards the end of the third century. In his youth he took a journey to Rome, in company with Amphibalus a monk of Caerleon, and served seven years as a soldier under the emperor Dioclesian. At his return home, he settled in Verulam; and, through the example and instructions of Amphibalus, renounced the ex-

rors of Paganism, in which he had been educated, and became a convert to the Christian religion. It is generally agreed, that Alban suffered martyrdom during the great persecution under the reign of Dioclesian; but authors differ as to the year when it happened: Bede and others fix it in 286; some refer it to the year 296; but Usher reckons it amongst the events of 303. The story and circumstances relating to his martyrdom, according to Bede, are as follow. Being yet a Pagan (or at least it not being known that he was a Christian), he entertained Amphibalus in his house. The Roman governor being informed thereof, sent a party of soldiers to apprehend Amphibalus; but Alban, putting on the habit of his guest, presented himself in his stead, and was carried before that magistrate. The governor having asked him of what family he was? Alban replied, "To what purpose do you inquire of my family? if you would know my religion, I am a Christian." Then being asked his name, he answered, "My name is Alban; and I worship the only true and living God, who created all things." The magistrate replied, "If you would enjoy the happiness of eternal life, delay not to sacrifice to the great gods." Alban answered, "The sacrifices you offer are made to devils; neither can they help the needy, or grant the petitions of their votaries." His behaviour so enraged the governor, that he ordered him immediately to be beheaded. In his way to execution, he was stopped by a river, over which was a bridge so thronged with spectators that it was impossible to cross it; the saint, as we are told, lifted up his eyes to heaven, and the stream was miraculously divided, and afforded a passage for himself and a thousand more persons. Bede does not indeed give us the name of this river; but, notwithstanding this omission, the miracle, we suppose, will not be the less believed. This wonderful event converted the executioner upon the spot, who threw away his drawn sword, and, falling at St Alban's feet, desired he might have the honour to die with him. This sudden conversion of the headsman occasioning a delay in the execution till another person could be got to perform the office, St Alban walked up to a neighbouring hill, where he prayed for water to quench his thirst, and a fountain of water sprung up under his feet: here he was beheaded on the 23d of June. The executioner is said to have been a signal example of divine vengeance; for as soon as he gave the fatal stroke, his eyes dropt out of his head. We may see the opinion of Mr Milton in regard to this narrative, in his *History of England*. His words are these, speaking of St Alban: "The story of whose martyrdom, soiled and worse martyred with the fabling zeal of some idle fancies, more fond of miracles than apprehensive of the truth, deserves no longer digression." Between 400 and 500 years after St Alban's death, Offa, king of the Mercians, built a very large and stately monastery to his memory; and the town of St Albans in Hertfordshire takes its name from our protomartyr.

ALBANA, in *Ancient Geography*, a sea-port town of Albania, on the Caspian sea, between the rivers Casius and Albanus; now called *Bachu*, or *Bachy*, giving name to the Caspian sea, viz. *Mer de Bahu*. E. Long. 49. 0. N. Lat. 40. 0.

ALBANENSES, in *Church History*, the same with *Albigenses*. See *ALBIGENSES*.

ALBANI,

Alban
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Albanense.

Albani.

ALBANI, in Roman antiquity, a college of the *Sallii*, or priests of Mars; so called from Mount Albanus, the place of their residence. See *SALLII*.

ALBANI, *Francis*, a celebrated painter, born in Bologna, March 17. 1578. His father was a silk merchant, and intended to bring up his son to that business; but Albani having a strong inclination to painting, when his father died, devoted himself entirely to that art, though then but twelve years of age. He first studied under Denys Calvert; Guido Rheni being at the same time under this master, with whom Albani contracted a very great friendship. Calvert drew but one profile for Albani, and afterwards left him entirely to the care of Guido; under whom he made great improvement, his fellow-disciple instructing him with the utmost humanity and good humour. He followed Guido to the school of the Caracci: but a little after their friendship for each other began to cool; which was owing perhaps to the pride of Albani, who could not bear to see Guido surpass him, or to the jealousy of Guido at finding Albani made such rapid progress. They certainly endeavoured to eclipse one another; for when Guido had set up a beautiful altar piece, Albani would oppose to it some fine picture of his: thus did they behave for some time, and yet spoke of each other with the highest esteem. Albani, after having greatly improved himself under the Caracci, went to Rome, where he continued many years, and married in that city; but his wife dying in childbed, at the earnest request of his relations he returned to Bologna, where he entered again into the state of matrimony. His second wife (*Doralice*) was well descended, but had very little fortune; which he perfectly disregarded, so strongly was he captivated with her beauty and good sense. Albani, besides the satisfaction of possessing an accomplished wife, reaped likewise the advantage of having a most beautiful model; so that he had now no occasion to make use of any other woman to paint a *Venus*, the *Graces*, *Nymphs*, and other deities, whom he took a particular delight in representing. His wife answered this purpose admirably well; for besides her bloom of youth, and the beauty of her person, he discovered in her so much modesty, so many graces and perfections, so well adapted to painting, that it was impossible for him to meet with a more finished woman. She afterwards brought him several boys, all extremely beautiful and finely proportioned; so that she and her children were the originals of his most agreeable and graceful compositions. *Doralice* was so conformable to his intentions, that she took a pleasure in setting the children in different attitudes, holding them naked, and sometimes suspended by strings, when Albani would draw them in a thousand different ways. It was from them, too, that the famous sculptors *Flamand* and *Argaldi* modelled their little *Cupids*.

Albani was of a happy temper and disposition; his paintings, says *Malvasia*, breathing nothing but content and joy. Happy in a force of mind that conquered every uneasiness, his poetical pencil carried him through the most agreeable gardens to *Paphos* and *Cytheria*: those delightful scenes brought him over the lofty *Parnassus* to the delicious abodes of *Apollo* and the *Muses*: whence what *Du Fresnoy* says of the famous *Giulio Romano* may be justly applied to Albani:

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Taught from a child in the bright *Muses* grots,
He open'd all the treasures of *Parnassus*,
And in the lively poetry of painting
The myst'ries of *Apollo* has reveal'd.

Albani

ii

Albano.

He died the 4th of October 1660, to the great grief of all his friends and the whole city of Bologna. *Malvasia* has preserved some verses of *Francisco de Lemene*, intended for his monument; the sense whereof is, "That the mortal remains of the illustrious Albani, he who gave life to shade, lie interred in this tomb: the earth never produced so wonderful an artist, or a hand equal to his immortal one; which gave colours to the soul, and a soul to colours. *Prometheus* animated clay, and gave life by means of the sun; but Albani animated merely by the assistance of shade." He was very famous in his lifetime, and had been visited by the greatest painters. Several princes honoured him with letters; and amongst the rest *King Charles I.* who invited him to England by a letter signed with his own hand.

ALBANIA, a province of Turkey in Europe, on the gulf of *Venice*, bounded by *Livadia* on the south, by *Thessaly* and *Macedonia* on the east, and on the north by *Bosnia* and *Dalmatia*. The people are strong, large, courageous, and good horsemen; but are said to be of a thievish disposition. The grand seignior procures excellent soldiers from hence, particularly cavalry, known by the name of *Arnauts*. There are several large towns in this province: and the inhabitants are almost all Christians of the Greek church, and descended from the ancient *Scythians*. Formerly it was part of the kingdom of *Macedonia*. Their chief manufacture is carpets. The principal places are *Durazzo*, *Velona*, *Antivari*, *Scutari*, *Croya*, *Alessio*, *Dibra*, *Dolcigno*, and *Albanapoli*. Long. from 19° to 22° E.; Lat. from 39° to 43° N. See ALBANIA, SUPPLEMENT.

ALBANIA, a country of Asia, bounded on the west by *Iberia*; on the east by the *Caspian sea*; on the north by *Mount Caucasus*; on the south by *Armenia*, and the river *Cyrus*, now *Kur*; which, springing from the *Moschian mountains* that separate *Colchis* from *Armenia*, and watering the country of *Mokan*, receives the *Aragus* and *Araxes*, and falls into the *Caspian sea* within a small distance from the southern borders of this country.—The whole country formerly called *Albania*, now goes under the names of *Schirwan* and *East Georgia*, and is extremely fruitful and pleasant. The ancient historians take notice of the Albanian men being tall, strong-bodied, and, generally speaking, of a very graceful appearance; far excelling all other nations in comeliness as well as stature. Modern travellers take no notice of the appearance of the men; but extol the beauty of the women, which seems to be unnoticed by the ancients. The Albanians were anciently an independent and pretty powerful people; but we find no mention made of their kings till the reign of *Alexander the Great*, to whom the king of *Albania* is said to have presented a dog of an extraordinary fierceness and size.—It does not appear that the Albanians were ever conquered by the Romans, even when their power was at the greatest height; though when they ventured to engage in war with that powerful empire, they were always defeated, as might naturally be expected.

ALBANO, a town of Italy, on a lake of the same name,

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Albano,
Alban's.

name, in the Campagna of Rome. It was called by the ancients *Albanum Pompeii*, and built out of the ruins of the ancient Alba Longa, which was destroyed by Tullus Hostilius. It stands within twelve miles south-east of Rome, and for the pleasantness of its situation is the summer retirement of a great many Roman princes. It is likewise the see of a bishop, who is one of the six senior cardinals. The town is famous for its excellent wine, and the ruins of a mausoleum, which, according to the tradition of the inhabitants, was made for Ascanius. The prospect from the garden of the Capuchins is extremely pleasant, taking in the Campania of Rome, and terminating in a full view of the Tuscan sea. Close by the town lies the Alban lake, of an oval figure, and about seven miles in circumference, which, by reason of the high mountains round it, looks like the area of a great amphitheatre. It abounds with excellent fish, and over against the hermitage it is said to be unfathomable. The mountain of Albano is called *Monte Cavo*; on the top of which was a celebrated temple dedicated to Jupiter and Juno. Near the Capuchins there is another convent of Franciscans; and not far from thence the palace of Cardinal Barberini, remarkable for very pleasant gardens, with the ruins of ancient baths, and several old fragments of mosaic work. E. Long. 12. 30. N. Lat. 41. 50.

ALBANO is also a town in the kingdom of Naples, remarkable for the fertility of the surrounding territory, and for the nobility of the inhabitants.

ALBAN'S, SAINT, a market town of Hertfordshire, on the north-west road from London, at the distance of 21 miles, and containing 3653 inhabitants in 1811. This town sends two members to parliament, gives the title of *duke* to the noble family of Beaulerc, and has one of the best markets for wheat in England. St Alban's is seated near the ruins of the ancient Roman city, by Tacitus called *Verulam*; and by the Saxons *Watlingcester*, because it is seated on the road called *Watling-street*. Nothing now remains of Verulam but the ruins of old walls; in the fields adjacent to which they continue to find Roman coins as they formerly found tessellated pavements. In memory of St Alban, Offa, king of the Mercians, anno 795, erected an abbey, calling it *St Alban's*; and near it the town of the same name was afterwards built. The church of the abbey is remaining to this day: time and the weather have made it look like stone on the outside; but if you break a bit off, the redness of the brick immediately appears. When the monasteries were dissolved, the townsmen paid 400l. to prevent its being levelled with the ground, and have since converted it into a parish-church, which, for its largeness, beauty, and antiquity, claims a particular regard. It had a very noble font of solid brass, in which the children of the kings of Scotland were used to be baptized; and was brought from Edinburgh, by Sir Philip Lea, when the city was in flames; but in the times of the late civil wars it was taken away. Not many years since, a tomb was discovered in this church, said to be that of Humphry duke of Gloucester: when the leaden coffin was opened, the body was pretty entire, being preserved in a sort of pickle. There was a stately cross in the middle of the town, as there was in many other places, where Queen Eleanor's body

rested when it was brought out of the north for interment at Westminster; but it is now demolished. W. Long. 0. 12. N. Lat. 51. 44.

ALBANUS MONS, in *Ancient Geography*, now called *Mont Albano*, 26 miles from Rome, near where Alba Longa stood.

ALBANUS MONS, in *Ancient Geography*, to the north of Istria, called *Albius* by Strabo; the extremity of the Alps, which, together with the mountains to the east, joining it, called *Montes Bævi*, separate the farther Liburnia and Dalmatia from Pannonia.

ALBANY, a fortress belonging to the British, seated on the S. W. of Hudson's bay. W. Long. 82. 10. N. Lat. 59. 20.

ALBANY, a town of North America, the capital of a county of the same name, in the province of New-York. It is a well built place, and contained 12,000 inhabitants in 1810. It is situated upon the Hudson river, and though 165 miles from the sea, sloop of 80 tons come up to it. W. Long. 44. 29. N. Lat. 42. 30.

ALBARAZIN, a strong town, and one of the most ancient of the kingdom of Arragon in Spain. It is seated on an eminence, near the river Guadalquivir, a little below its source, and on the frontiers of Valencia and New Castile. It is the seat of a bishop, and produces the best wool in all Arragon. It is about 100 miles east of Madrid. E. Long. 1. 20. N. Lat. 40. 32.

ALBARII, in antiquity, properly denoted those who gave the whitening to earthen vessels, &c. In which sense they stood contradistinguished from *Dealbatores*, who whitened walls.

ALBARIUM OPUS, in the ancient building, the incrustation or covering of the roofs of houses with white plaster, made of mere lime. This is otherwise called *opus album*. It differed from *Tectorium*, which is a common name given to all roofing or ceiling, including even that formed of lime and sand, or lime and marble; whereas *Albarium* was restrained to that made of lime alone.

ALBATEGNI, an Arabic prince of Batan in Mesopotamia, and a celebrated astronomer, who lived about the year of Christ 880, as appears by his observations. He is also called *Muhammed ben Geber Albatani*, *Mahomet the son of Geber*, and *Muhammedes Aractensis*. He made astronomical observations at Antioch, and at Racah or Aracta, a town of Chaldea. He is highly spoken of by Dr Halley, as a man of admirable genius, and an excellent observer.

Instead of the tables of Ptolemy, which were imperfect, he computed new ones: these were adapted to the meridian of Aracta or Racah, and were long used as the best among the Arabs. Albategni composed in Arabic a work under the title of *The Science of the Stars*, comprising all parts of astronomy, according to his own observations and those of Ptolemy. This work was translated into Latin by Plato of Tibur, and published at Nuremberg in 1537, with some additions and demonstrations of Regiomontanus. It was reprinted at Bologna in 1645, with this author's notes. Dr Halley detected many faults in these editions: *Philos. Trans.* for 1693, N° 204. In this work, Albategni gives the motion of the sun's apogee since Ptolemy's time, as well as the motion of the stars, which he makes

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Albategni

Albategni ||
Albati. makes one degree in 70 years. He made the longitude of the first star of Aries to be $18^{\circ} 2'$; and the obliquity of the ecliptic $23^{\circ} 35'$. Upon Albategni's observations were founded the Alphonsine tables of the moon's motion. (*Hutton's Math. Dict.*)

ALBATI EQUI, an appellation given to such horses, in the games of the ancient circus, as wore white furniture.

ALBATROSS, in *Ornithology*, a species of the diomedea. See DIOMEDEA, ORNITHOLOGY *Index*.

ALBAZIN, a town of Greater Tartary, with a strong castle. It is situated upon the river Amur, or Yamour, and belongs to the Russians. E. Long. 103. 30. N. Lat. 54. 0.

ALBE, a small piece of money, current in Germany, worth only a French sol and seven deniers.

ALBEMARLE, or AUMALE, a town of France, in Upper Normandy, now in the department of Seine Inferior, from whence the noble family of Keppel takes the title of *earl*. It is seated on the declivity of a hill, on the confines of Picardy, 35 miles north-east of Rouen, and 70 north-west of Paris. E. Long. 1. 42. N. Lat. 49. 50.

ALBEMARLE, the most northern part of the province of North Carolina in America.

ALBENGUA, a town of Italy, in the territory of Genoa. It is the see of a bishop, and is a very ancient handsome town, but not well peopled on account of the insalubrity of the air. It is seated in a very beautiful plain, which is well cultivated; and the outside of the town is surrounded with olive trees. It is a seaport, about 30 miles south-west of Genoa. E. Long. 8. 13. N. Lat. 44. 4.

ALBERNUO, a kind of camlet, brought from the Levant by the way of Marseilles.

ALBERONI, JULIUS, the son of a poor gardener in the suburbs of Placentia, born in 1664; who, by his great abilities and good fortune, rose from this low origin to the employment of first minister of state at the court of Spain, and to the dignity of cardinal. He roused that kingdom out of the lethargy it had sunk into for a century past; awakened the attention, and raised the astonishment of all Europe, by his projects; one of which was to set the Pretender on the throne of Great Britain. He was at length deprived of his employment, and banished to Rome. He died in 1752, at the great age of 89. His *Testament Politique*, collected from his memoirs and letters, was published at Lausanne in 1753.

ALBERT, Margrave of Brandenburg, and the last grand master of the Teutonic order, laid aside the habit of his order, embraced Lutheranism, and concluded a peace at Cracow in 1525, by which he was acknowledged duke of the east part of Prussia (formerly called for that reason *Ducal Prussia*), but to be held as a fief of Poland, and to descend to his male heirs. See PRUSSIA.

ALBERTI, LEONE BATTISTA, was descended from a noble family of Florence; and was perfectly acquainted with painting, sculpture, and architecture. He wrote of all three in Latin; but his studies did not permit him to leave any thing considerable behind him in painting. He was employed by Pope Nicholas V. in his buildings, which he executed in a beautiful manner; and his work on architecture, which consists of

10 books, is greatly esteemed. He also wrote some treatises of morality, and a piece of arithmetic. He died in 1485.

ALBERTISTS, a sect of scholastics, so named from their leader Albertus Magnus.

ALBERTUS, MAGNUS, a Dominican friar, and afterwards bishop of Ratisbon, was one of the most learned men and most famous doctors of the 13th century. He is said to have acted as a man-midwife; and some have been highly offended that one of his profession should follow such an employment. A book entitled *De Natura Rerum*, of which he was reputed the author, gave rise to this report. In this treatise there are several instructions for midwives, and so much skill shown in their art, that one would think the author could not have arrived at it without having himself practised: but the advocates for Albert say he was not the writer thereof, nor of that other piece *De Secretis Mulierum*; in which there are many phrases and expressions unavoidable on such a subject, which gave great offence, and raised a clamour against the supposed author. It must be acknowledged, however, that there are, in his Comment upon the Master of Sentences, some questions concerning the practice of conjugal duty, in which he has used some words rather too gross for chaste and delicate ears; but they allege, what he himself used to say in his own vindication, that he came to the knowledge of so many monstrous things at confession, that it was impossible to avoid touching upon such questions. Albert was certainly a man of a most curious and inquisitive turn of mind, which gave rise to other accusations brought against him. It is said, that he laboured to find out the philosopher's stone; that he was a magician; and that he made a machine in the shape of a man, which was an oracle to him, and explained all the difficulties he proposed. He had great knowledge in the mathematics, and by his skill in that science might probably have formed a head with springs capable of articulating sounds; like to the machines of Boetius, of which Cassiodorus has said, "Metals low; the birds of Diomedes trumpet in brass; the brazen serpent hisses; counterfeited swallows chatter, and such as have no proper note, from brass send forth harmonious music." John Matthæus de Luna, in his treatise *De Rerum Inventoribus*, has attributed the invention of fire-arms to Albert; but in this he is confuted by Naude, in his *Apologie des Grandes Hommes*. Albert died at Cologne in 1280. His works were printed at Lyons, in 1651, in 21 volumes folio.

ALBERTUS, a gold coin, worth about fourteen French livres: it was coined during the administration of Albertus archduke of Austria.

ALBESIA, in antiquity, a kind of shields, otherwise called *Decumana*. See DECUMANA.

ALBI, a city of France, in the department of the Tarn, the capital of the Albigeois, in Upper Languedoc. The cathedral is dedicated to St Cecilia, and has one of the finest choirs in the kingdom. Here is a very valuable silver shrine, of exquisite workmanship, of the mosaic kind: it contains the reliques of St Clair, the first bishop of this city. The chapel of this pretended saint is magnificent, and adorned with paintings. The Lice is a fine large walk without the city: what distinguishes this from all others, is a terrace

Alberti
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Albi.

Albi, above a deep mall, which serves instead of a fosse; it is bordered with two rows of very fine trees, which are kept in excellent order. There are four gates, through which you may view all the beauties of a delightful plain. At one end of this is the convent of the Dominicans. The archbishop's palace is very beautiful. The river washes its walls, and serves both for an ornament and defence. This city is seated on the river Tarn, 35 miles north-east of Toulouse, and contained 9860 inhabitants by the last census. E. Long. 2. 9. N. Lat. 43. 56.

The Albigeois is a small territory, about twenty-seven miles in length, and twenty in breadth, abounding in corn, wood, grapes, saffron, plums, and sheep; and the inhabitants have a great trade in dried prunes, grapes, a coarse sort of cloth, and wine of Gaillac. These wines are the only sort hereabouts that are fit for exportation: they are carried down to Bourdeaux, and generally sold to the British. They have likewise several coal mines.

ALBIGENSES, in church history, a sect or party of reformers, about Toulouse and Albigeois in Languedoc, who sprung up in the 12th century, and distinguished themselves by their opposition to the discipline and ceremonies of the Romish church.

This sect had their name, it is supposed, either by reason there were great numbers of them in the diocese of Albi, or because they were condemned by a council held in that city. In effect, it does not appear that they were known by this name before the holding of that council. The *Albigenses* were also called *Albiani*, *Albigesei*, *Albii*, and *Albanenses*, though some distinguish these last from them. Other names given to them are *Henricians*, *Abelardists*, *Bulgarians*, &c.; some on account of the qualities they assumed; others on that of the country from whence it is pretended they were derived; and others on account of persons of note who adopted their cause, as Peter de Brius, Arnold de Bresse, Abelard, Henry, &c. Berengarius, if not Wickliff himself, is by some ranked in the number. The *Albigenses* are frequently confounded with the *Waldenses*; from whom, however, they differ in many respects, both as being prior to them in point of time, as having their origin in a different country, and as being charged with divers heresies, particularly Manicheism, from whence the *Waldenses* are exempt. But several Protestant writers have vindicated them from that imputation. Dr Allix shows that a great number of *Manichees* did spread over the western countries from Bulgaria; and settled in Italy, Languedoc, and other places, where there were also *Albigenses*; by which means, being both under the imputation of *heresy*, they came, either by ignorance or malice, to be confounded, and called by the same common name, though in reality entirely different.

Other errors imputed to them by their opponents, the monks of those days, were, That they admitted two Christs; one evil, who appeared on earth; the other good, who has not yet appeared: That they denied the resurrection of the body; and maintained human souls to be demons imprisoned in our bodies, by way of punishment for their sins: That they condemned all the sacraments of the church; rejected baptism as useless; held the eucharist in abhorrence; excluded the use of confessions and penance; maintained

marriage unlawful; laughed at purgatory, prayers for the dead, images, crucifixes, &c. There were likewise said to be two classes of them; the Perfect and the Believers. The perfect boasted of their living in continence, of eating neither flesh, eggs, nor cheese. The believers lived like other men, and were even loose in their morals; but they were persuaded they should be saved by the faith of the perfect, and that none were damned who received imposition of hands from them. But from these charges also they are generally acquitted by Protestants, who consider them as the pious inventions of the Romish church, whose members deem it meritorious by any means to blacken heretics.

However this be, the *Albigenses* grew so formidable, that the Catholics agreed upon a holy league or crusade against them. They were at first supported by Raimond, count of Toulouse. Pope Innocent III. desirous to put a stop to their progress, sent a legate into their country; which failing, he stirred up Philip Augustus, king of France, and the other princes and great men of the kingdom, to make war upon them. Upon this the count of Toulouse, who had sided with them, made his submission to the pope, and went over to the Catholics: but soon after, finding himself plundered by the crusaders, he declared war against them, and was joined by the king of Arragon. His army was defeated at the siege of Muret, where he himself was killed, and the defeat followed by the surrender of the city of Toulouse, and the conquest of the greatest part of Languedoc and Provence. His son Raymond succeeded him; who agreed with the king and the pope to set up the inquisition in his estates, and to extirpate the *Albigenses*. In an assembly held at Milan, the archbishop of Toulouse drew up articles; agreeable to which the count made a most ample declaration against them, which he published at Toulouse in 1253. From this time the *Albigenses* dwindled by little and little, till the time of the Reformation; when such of them as were left fell in with the *Vaudois*, and became conformable to the doctrine of Zuinglius and the discipline of Geneva.

ALBIGENSES is also a name sometimes given to the followers of Peter Vaud, or Waldo; and hence synonymous with what we more properly call *Waldenses*, or Poor Men of Lyons. In this sense the word is applied by Camerarius, Thuanus, and several other writers. The reason seems to be, that the two parties agreed in their opposition to the papal innovations and encroachments, though in divers other respects said to be different enough. The bishop of Meaux labours hard to support a distinction between the two sects, alleging that the *Albigenses* were heretics and Manichees; whereas the *Waldenses* were only schismatics, not heretics; being sound as to articles of faith, and only separating from the church of Rome on account of forms and discipline. Dr Allix endeavours to set aside the distinction: and shows, that both of them held the same opinions, and were equally condemned and held for heretics; and this not for points of faith, but for declining against the papal tyranny and idolatry, and holding the pope to be the Antichrist; which last, according to M. de Meaux, constitutes nothing less than Manicheism. In this sense the Lollards and Wickliffites in England were not only *Albigenses* but Manichees.

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albinos.

ALBINTEMELIUM, ALBINTIMILIUM (Tacitus); or, at full length, ALBIUM INTEMELIUM (Pliny, Strabo); now *Vintimiglia*, situated in the south-west of the territory of Genoa, near the borders of the county of Nice, with a port on the Mediterranean, at the mouth of the rivulet Rotta, about half-way between Monaco and St Remo. E. Long. 7. 40. N. Lat. 43. 17.

ALBIOECE, or ALEBECE (Pliny, Strabo); otherwise called *Reii Apollinares*, from their superstitious worship of Apollo; also *Civitas Reiensium*; now *Riez*, in Provence, about 18 leagues to the north-east of Toulon, on the north side of the rivulet Verdon; was originally a Roman colony (Inscription). It is sometimes written *Regium*. The people were called *Albici*, (Cæsar). E. Long. 1. 0. N. Lat. 43. 20.

ALBINI, in antiquity, the workmen employed in what was called *Opus Albarium*. They make a different profession from the *dealbatores* or *whiteners*.

ALBINOS, the name by which the Portuguese call the white Moors, who are looked upon by the negroes as monsters. They at a distance might be taken for Europeans; but when you come near them, their white colour appears like that of persons affected with a leprosy.

In Saussure's *Voyages dans les Alpes*, is the following account of the two boys, at Chamouni, who have been called *Albinos*. "The elder, who was at the end of the year 1785 about twenty or one-and-twenty years of age, had a dull look, with lips somewhat thick, but nothing else in his features to distinguish him from other people. The other, who is two years younger, is rather a more agreeable figure; he is gay and sprightly, and seems not to want wit. But their eyes are not blue; the iris is of a very distinct rose colour; the pupil, too, when viewed in the light, seems decidedly red; which seems to demonstrate, that the interior membranes are deprived of the uvea, and of that black mucous matter that should line them. Their hair, their eye-brows, and eye-lashes, the down upon their skin, were all in their infancy, of the most perfect milk-white colour, and very fine; but their hair is now of a reddish cast, and has grown pretty strong. Their sight, too, is somewhat strengthened; though they exaggerate to strangers their aversion for the light, and half shut the eyelids, to give themselves a more extraordinary appearance. But those who, like me, have seen them in their infancy, before they were tutored to this deceit, and when too few people came to Chamouni to make this affectation profitable to them, can attest that then they were not very much offended with the light of day. At that time they were so little desirous of exciting the curiosity of strangers, that they hid themselves to avoid such; and it was necessary to do a sort of violence to them before they could be prevailed on to allow themselves to be inspected. It is also well known at Chamouni, that when they were of a proper age they were unable to tend the cattle like the other children at the same age; and that one of their uncles maintained them out of charity, at a time of life when others were capable of gaining a subsistence by their labour.

"I am therefore of opinion, that we may consider these two lads as two albinos; for if they have not the thick lips and flat noses of the white negroes, it is be-

cause they are albinos of Europe, not of Africa. This infirmity affects the eyes, the complexion, and the colour of the hair; it even diminishes the strength, but does not alter the conformation of the features. Besides, there are certainly in this malady various degrees; some may have less strength, and be less able to endure the light: but these circumstances in those of Chamouni are marked with characters sufficiently strong to entitle them to the unhappy advantage of being classed with that variety of the human species denominated albinos.

"When nature presents the same appearance often, and with circumstances varied, we may at last discover some general law, or some relation which that appearance has with known causes; but when a fact is so singular and so rare, as that of those albinos, it gives but little scope to a conjecture: and it is very difficult to verify those by which we attempt to explain it.

"I at first imagined that this disease might be referred to a particular sort of organic debility; that a relaxation of the lymphatic vessels within the eye might suffer the globules of the blood to enter too abundantly into the iris, the uvea, and even into the retina, which might occasion the redness of the iris and of the pupil. The same debility seemed also to account for the intolerance of the light, and for the whiteness of the hair.

"But a learned physiologist, M. Blumenbach, professor in the university at Gottingen, who has made many profound observations on the organs of sight, and has considered with great attention the albinos of Chamouni, attributes their infirmity to a different cause.

"The study of comparative anatomy has furnished him with frequent opportunities of observing this phenomenon; he has found it in brutes, in white dogs, and in owls; he says, it is generally to be seen in the warm-blooded animals; but that he has never met with it in those with cold blood.

"From his observations, he is of opinion, that the redness of the iris, and of the other internal parts of the eye, as well as the extreme sensibility that accompanies this redness, is owing to the total privation of that brown or blackish mucus, which, about the fifth week after conception, covers all the interior parts of the eye in its sound state. He observes, that Simon Pontius, in his treatise *de Coloribus Oculorum*, long ago remarked, that in blue eyes the interior membranes were less abundantly provided with this black mucus, and were therefore more sensible to the action of light. This sensibility of blue eyes agrees very well, says M. Blumenbach, with northern people, during their long twilight; while, on the contrary, the deep black in the eyes of negroes enables them to support the splendour of the sunbeams in the torrid zone.

"As to the connection between this red colour of their eyes, and the whiteness of the skin and hair, the same learned physiologist says, that it is owing to a similarity of structure, *consensus ex similitudine fabricæ*. He asserts, that this black mucus is formed only in the delicate cellular substance, which has numerous blood-vessels contiguous to it, but contains no fat; like the inside of the eye, the skin of negroes, the spotted palate of several domestic animals, &c. And, lastly, he

Albinos.

says,

Albinos. says that the colour of the hair generally corresponds with that of the iris. *Gazette Litt. de Göttingue*, Oct. 1784.

"At the very time that M. Blumenbach was reading this memoir to the Royal Society of Göttingen, M. Buzzi, surgeon to the hospital at Milan, an eleve of the celebrated anatomist Moscati, published in the *Opuscoli Scelti de Milan*, 1784, tom. ii. p. 11. a very interesting memoir, in which he demonstrates by dissection what Blumenbach had only supposed.

"A peasant of about 30 years of age died in the hospital of Milan of a pulmonary disorder. His body, being exposed to view, was exceedingly remarkable by the uncommon whiteness of the skin, of the hair, of the beard, and of all the other covered parts of the body. M. Buzzi, who had long desired an opportunity of dissecting such a subject, immediately seized upon this. He found the iris of the eyes perfectly white, and the pupil of a rose colour. The eyes were dissected with the greatest possible care, and were found entirely destitute of that black membrane which anatomists call the *uvea*: it was not to be seen either behind the iris or under the retina. Within the eye there was only found the choroid coat extremely thin, and tinged of a pale red colour, by vessels covered with discoloured blood. What was more extraordinary, the skin, when detached from different parts of the body, seemed almost entirely divested of the *rete mucosum*: maceration did not discover the least vestige of this, not even in the wrinkles of the abdomen, where it is most abundant and most visible.

"M. Buzzi likewise accounts for the whiteness of the skin and of the hair, from the absence of the *rete mucosum*, which, according to him, gives the colour to the cuticle, and to the hairs that are scattered over it. Among other proofs of this opinion, he alleges a well-known fact, that if the skin of the blackest horse be accidentally destroyed in any part of the body, the hairs that afterwards grow on that part are always white, because the *rete mucosum* which tinges those hairs is never regenerated with the skin.

"The proximate cause of the whiteness of albinos, and the colour of their eyes, seems therefore pretty evidently to depend on the absence of the *rete mucosum*: But what is the remote cause?

"In the first place, it seems probable that men affected with this infirmity form no distinct species, for they are produced from parents that have dark skins and black eyes. What is it then that destroys the *rete mucosum* in such persons? M. Buzzi relates a singular fact, which seems to throw some light on this subject.

"A woman of Milan, called Calcagni, had seven sons. The two eldest had brown hair, and black eyes; the three next had white skins, white hair, and red eyes; the two last resembled the two eldest. It was said that this woman, during the three pregnancies that produced the albinos, had a continual and immoderate appetite for milk, which she took in great quantities: but that when she was with child of the other four children, she had no such desire. It is not however ascertained, that this preternatural appetite was not itself the effect of a certain heat, or internal disease, which destroyed the *rete mucosum* in the children before they were born.

"The albinos of Chamouni are also the offspring of parents with dark skins and black eyes. They have three sisters by the same father and mother, who are also brunettes. One of them that I saw had the eyes of a dark brown, and the hair almost black. They are said, however, to be all afflicted with a weakness of sight. When the lads are married, it will be curious to observe how the eyes of their children will be formed. The experiment would be particularly decisive if they were married to women like themselves. But this faulty conformation seems to be more rare among women than among men; for the four of Milan, the two of Chamouni, the one described by Maudpertsuis, the one by Helvetius, and almost all the instances of these singular productions, have been of our sex. It is known, however, that there are races of men and women affected with this disease, and that these races perpetuate themselves in Guinea, in Java, at Panama, &c.

"Upon the whole, this degeneration does not seem to be owing to the air of the mountains; for though I have traversed the greatest part of the Alps, and the other mountains of Europe, these are the only individuals of that kind that I ever met with."

ALBINOVANUS, a Latin poet, whom Ovid sur-named the *Divine*. There is now nothing of his extant, except an elegy on Drusus, and another on the death of Mæcenas.

ALBINUS, BERNHARD SIEGFRED, a celebrated physician and anatomist, was born of an illustrious family at Francfort on the Oder in 1697. His father was then professor of the practice of medicine in the university of Francfort; but in the year 1702 he repaired to Leyden, being nominated professor of anatomy and surgery in that university. Here his son had an opportunity of studying under the most eminent masters in Europe, who, from the singular abilities which he then displayed, had no difficulty in prognosticating his future eminence. But while he was distinguished in every branch of literature, his attention was particularly turned to anatomy and surgery. His peculiar attachment to these branches of knowledge gained him the intimate friendship of Ruysch and Rau, who at that time flourished in Leyden; and the latter, so justly celebrated as a lithotomist, is said to have seldom performed a capital operation without inviting him to be present. Having finished his studies at Leyden, he went to Paris, where he attended the lectures of Du Verney, Vaillant, and other celebrated professors. But he had scarce spent a year there when he was invited by the curators of the university of Leyden to be a lecturer of anatomy and surgery at that place. Though contrary to his own inclination, he complied with their request, and upon that occasion was created doctor of physic without any examination. Soon after, upon the death of his father, he was appointed to succeed him as a professor of anatomy; and upon being admitted into that office on the 9th of November 1721, he delivered an oration, *De vera via ad fabricæ humani corporis cognitionem ducente*; which was heard with universal approbation. In the capacity of a professor, he not only bestowed the greatest attention upon the instruction of the youth intrusted to his care, but in the improvement of the medical art. With this view he published many important discoveries of his own; and

Albinos
||
Albinus.

Albinus
||
Alborak.

by elegant editions, turned the attention of physicians to works of merit, which might otherwise have been neglected. By these means his fame was soon extended over Europe; and the societies of London, Petersburg, and Haerlem, cheerfully received him as an associate. In 1745, he was appointed professor of the practice of medicine at Leyden, and was succeeded in the anatomical chair by his brother Frid. Bern. Albinus. He was twice rector of the university, and as often he refused that high honour when it was voluntarily offered him. At length, worn out by long service and intense study, he died on the 9th of September 1770, in the 74th year of his age.

ALBION, the ancient name of Britain.

New ALBION, a name given by Sir Francis Drake to California, on the north-west coast of America, which he discovered and took possession of in the year 1578. Captain Cook visited this coast in 1778, and landed in a place situated in N. Lat. 44. 33. E. Long. 235. 20. In the year 1792, it was again visited by Captain Vancouver, who was employed in surveying the western coast of North America. The name is now applied to a country farther north than California, but without any definite boundaries.

ALBIREO, in *Astronomy*, a star of the third or fourth magnitude, in the constellation **CYGNUS**.

ALBIS, in *Ancient Geography*, now the Elbe, which divided ancient Germany in the middle, and was the boundary of this country, so far as it was known to the Romans; all beyond they owned to be uncertain, no Roman except Drusus and Tiberius having penetrated so far as the Elbe. In the year of the building of the city 744, or about six years before Christ, Domitius Ahenobarbus, crossing the river with a few, merited the ornaments of a triumph; so glorious was it reckoned at Rome to have opened this passage. In the following age, however, the river that before occupied the middle of ancient Germany, became its boundary to the north, from the irruptions of the Sarmatæ, who possessed themselves of the Transalbin Germany. The Elbe rises in the borders of Silesia out of the Risenberg, runs through Bohemia, Misnia, Upper Saxony, Anhalt, Magdeburg, Brandenburg, Danneberg, Lauenburg, Holstein, and after being swelled by many other rivers, and passing by Hamburg and Gluckstadt, to both which places the river is navigable by large vessels, falls into the German or North sea.

ALBISOLA, a small town belonging to the republic of Genoa. Here is a porcelain manufacture, and several country-houses of the Genoese nobility. It was bombarded in 1745 by the English. E. Long. 8. 20. N. Lat. 44. 15.

ALBOGALERUS, in Roman antiquity, a white cap worn by the *flamen Dialis*, on the top of which was an ornament of olive branches.

ALBORAK, amongst the Mahometan writers, the beast on which Mahomet rode in his journeys to heaven. The Arab commentators give many fables concerning this extraordinary mode of conveyance. It is represented as of an intermediate shape and size between an ass and a mule. A place, it seems, was secured for it in paradise at the intercession of Mahomet; which, however, was in some measure extorted from the prophet, by Alborak's refusing to let him mount

when the angel Gabriel was come to conduct him to heaven.

ALBORO, in *Zoology*, a name by which the erythrinus, a small red fish caught in the Mediterranean, is commonly known in the markets of Rome and Venice.

ALBOURG, a town of Denmark, in North Jutland, capital of the diocese of the same name, and a bishop's see. It has this name, which signifies *eel-town*, on account of the great number of eels taken here. It is seated on a canal, 10 miles from the sea, 30 north of Wiburg, and 50 north of Arhuys. It has an exchange for merchants, and a safe and deep harbour. They have a considerable trade in herrings and corn; and a manufactory of guns, pistols, saddles, and gloves. E. Long. 9. 50. N. Lat. 57. 2.

ALBRICIUS, born at London, was a great philosopher, a learned and able physician, and well versed in all the branches of polite literature. He lived in the 11th century, and wrote several works in Latin; particularly, 1. Of the Origin of the Gods. 2. The Virtues of the Ancients. 3. The Nature of Poison, &c.

ALBUCA, **BASTARD STAR-OF-BETHLEHEM**. See **BOTANY Index**.

ALBUGINEA TUNICA, in *Anatomy*, the third or innermost coat or covering of the testes; it is likewise the name given to one of the coats of the eye.

ALBUGINEUS, in *Anatomy*, a term sometimes applied to the aqueous humour of the eye.

ALBUGO, or **LEUCOMA**, in *Medicine*, a distemper occasioned by a white opaque spot growing on the cornea of the eye, and obstructing vision. See **MEDICINE Index**.

ALBUM, in *Antiquity*, a kind of white table or register, wherein the names of certain magistrates, public transactions, &c. were entered. Of these there were various sorts; as the *album decurionum*, *album senatorum*, *album judicum*, *album prætoris*, &c.

ALBUM Decurionum, was the register wherein the names of the decuriones were entered. This is otherwise called *matriculatio decurionum*.

ALBUM Senatorum, the list of senators names which was first introduced by Augustus, and renewed yearly.

ALBUM Judicum, that wherein the names of the persons of those *decurie* who judged at certain times were entered.

ALBUM Prætoris, that wherein the *formulae* of all actions, and the names of such judges as the prætor had chosen to decide causes, were written.

The high priest entered the chief transactions of each year into an *album*, or table, which was hung up in his house for the public use.

ALBUM is also used, in later times, to denote a kind of table, or pocket-book, wherein the men of letters with whom a person has conversed, inscribed their names with some sentence or motto.

ALBUM Græcum, the white dung of dogs, formerly prescribed for inflammations of the throat, &c. but now disused, and chiefly employed by leather-dressers to soften leather after the application of lime.

ALBUMAZAR, a learned Arabian astronomer in the tenth century, who wrote a treatise Of the Revolution of the Years.

ALBUMEN, a substance found both in animal and vegetable.

Alborak
||
Albumen.

Albumen
||
Alcæus.

vegetable matters, and in great abundance in the white of eggs. See CHEMISTRY Index.

ALBUQUERQUE, a town of Spain, in the province of Estremadura, is seated on an eminence, nine miles from the frontiers of Portugal, and containing 5500 inhabitants. It is commanded by an almost impregnable fortress, built on a high mountain, and serving to defend the town. It has some trade in wool and woollen manufactures. It was taken by the allies of Charles king of Spain in 1705. W. Long. 7. 0. N. Lat. 38. 52.

ALBURN, the English name of a compound colour, being a mixture of white and red, or reddish brown. Skinner derives the word, in this sense, from the Latin *albus*, and the Italian *burno*, from *bruno*, "brown."

ALBURNUM, the soft white substance which in trees is found between the liber or inner bark and the wood, and in process of time acquiring solidity, becomes itself the wood. From its colour and comparative softness, it has been styled by some writers the fat of trees, *adeps arborum*.

The alburnum is found in largest quantities in trees that are vigorous; though in such as languish, or are sickly, there is a great number of beds. In an oak six inches in diameter, this substance is nearly equal in bulk to the wood. In a trunk of one foot diameter, it is as one to three and a half; of two and a half feet diameter, as one to four and a half, &c. but these proportions vary according to the health and constitution of the trees.—The alburnum is frequently gnawed in pieces by insects, which lodge in the substance, and are nourished from it.

ALBURNUS, in *Zoology*, a species of the *cyprinus* of Linnæus. See *CYPRINUS*, *ICHTHYOLOGY* Index.

ALCA, or **AUK**. See *ORNITHOLOGY* Index.

ALCÆUS, a famous ancient lyric poet, born at Mitylene, in the island of Lesbos. Horace seems to think him the inventor of this kind of poesy;

Now the Roman muse inspire,
And warm the song with Grecian fire. FRANCIS.

He flourished in the 44th Olympiad, at the same time with Sappho, who was likewise of Mitylene. Alcæus was a great enemy to tyrants, but not a very brave soldier. He was present at an engagement, wherein the Athenians gained a victory over the Lesbians; and here, as he himself is said to have confessed in one of his pieces, he threw down his arms, and saved himself by flight. Horace, who, of all the Latin poets, most resembled Alcæus, has made the like confession:

With thee I saw Philippi's plain,
Its fatal rout, a fearful scene!
And dropp'd, alas! th' inglorious shield,
Where valour's self was forc'd to yield;
Where soil'd in dust the vanquish'd lay,
And breath'd th' indignant soul away. FRANCIS.

The poetical abilities of Alcæus are indisputable; and though his writings were chiefly in the lyric strain, yet his muse was capable of treating the sublimest subjects with a suitable dignity. Hence Horace says,

Alcæus strikes the golden strings,
And seas, and war, and exile, sings.
Thus while they strike the various lyre,
The ghosts the sacred sounds admire:

But when Alcæus lifts the strain
To deeds of war and tyrants slain,
In thicker crowds the shadowy throng
Drink deeper down the martial song. FRANCIS.

ALCÆUS, an Athenian tragic poet, and, as some think, the first composer of tragedies. He renounced his native country Mitylene, and passed for an Athenian. He left 10 pieces, one of which was Pasiphaë, that which he produced when he disputed with Aristophanes, in the 4th year of the 97th Olympiad.

There is another **ALCÆUS** mentioned in Plutarch, perhaps the same whom Porphyrius mentions as a composer of satirical iambics and epigrams, and who wrote a poem concerning the plagiarism of Euphorus the historian. He lived in the 145th Olympiad.

We are told likewise of one **ALCÆUS**, a Messenian, who lived in the reign of Vespasian and Titus. We know not which of these it was who suffered for his lewdness a very singular kind of death, which gave occasion to the following epitaph:

Αλκαίης τάφος ὅτος, &c.

This is Alcæus's tomb; who died by a radish,
The daughter of the earth, and punisher of adulterers.

This punishment inflicted on adulterers, was thrusting one of the largest radishes up the anus of the adulterer: or, for want of radishes, they made use of a fish with a very large head, which Juvenal alludes to:

Quosdam mæchos et mugilis intrat. Sat. x.
The mullet enters some behind.

Hence we may understand the menace of Catullus,

Ah! tum te miserum, mulique fati,
Quem attractus pedibus, patente porta,
Percurrent raphanique, mugilesque. Epig. xv.

Ah! wretched thou, and born to luckless fate,
Who art discover'd by the unshut gate!
If once, alas! the jealous husband come,
The radish or the sea-fish is thy doom.

ALCAICS, in *Ancient Poetry*, a denomination given to several kinds of verse, from Alcæus, their inventor.

The first kind consists of five feet, viz. a spondee, or iambic; an iambic; a long syllable; a dactyle; another dactyle: such is the following verse of Horace:

Omnes | eo|dem cogimur, | omnium
Versa|tur ur|na | serius | ocyus |
Sors exitura.

The second kind consists of two dactyles and two trochees: as,

Exili|um imposi|tura | cymbæ.

Besides these two, which are called *dactylic Alcaics*, there is another simply styled *Alcaic*; consisting of an epitrite; a choriambus; another choriambus; and a bacchius: the following is of this species,

Cur timet fla|vum Tiberim tan|gere, cur | olivum ?

ALCAIC Ode, a kind of manly ode, composed of several strophes, each consisting of four verses; the two first of which are always alcaics of the first kind; the third verse is a dimeter hypercatalectic, or consisting of four feet and a long syllable; and the fourth verse is an alcaic of the second kind. The following strophe is

Alcæus
||
Alcaic.

is of this species, which Horace calls *minaces Alcae*
camenæ.

Non possidentem multa vocaveris

Recte beatum: rectius occupat

Nomen beati, qui deorum

Muneribus sapienter uti, &c.

ALCAID, ALCAYDE, or ALCALDE, in the polity of the Moors, Spaniards, and Portuguese, a magistrate, or officer of justice, answering nearly to the French provost and the British justice of peace.—The alcaid among the Moors is vested with supreme jurisdiction, both in civil and criminal cases.

ALCALA DE GUADEIRA, a small town of Spain, in Andalusia, upon the river Guadeira. Here are abundance of springs, from whence they convey water to Seville by an aqueduct. W. Long. 6. 16. N. Lat. 37. 15.

ALCALA de Henares, a beautiful and large city of Spain, in New Castile, seated upon the river Henares, which washes its walls. Its population, which was large in the 16th century, does not now exceed 5000. The streets are handsome and pretty straight: one of them is very long, running from one end of the city to the other. The houses are well built; and there are several squares, the largest of which is an ornament to the city: it is surrounded on all sides with piazzas, where tradesmen have their shops, to expose several sorts of commodities to sale, of which there is as great plenty and variety as in most towns of Spain. The university was founded by Cardinal Ximenes, archbishop of Toledo, about the beginning of the 15th century, contained 24 colleges, and was, after that of Salamanca, the most celebrated in Spain. The land about Alcala is watered by the Henares, and yields grain, very good muscat wine, and melons of a delicious kind. Without the walls is a spring, the water of which is so pure and so well tasted, that it is inclosed and shut up for the king of Spain's own use, from whence it is carried to Madrid.—This city is 10 miles south-west of Guadalaxara, and 13 miles east of Madrid. W. Long. 3. 42. N. Lat. 40. 30.

ALCALA-Real, a small city of Spain, in Andalusia, with a fine abbey. It is built on the top of a high mountain, in a mountainous country, nine leagues from Jaen. It bears the title of a city, and contains a rich abbey, and a population of 8000 or 9000. W. Long. 4. 15. N. Lat. 37. 18.

ALCALY, or ALCALI, or ALKALI. See CHEMISTRY Index.

ALCANIS, a town of Arragon in Spain, seated on the river Guadaloupe, 12 miles from Caspe. It was formerly the capital of the kingdom of the Moors; but being taken from them, it was made a commandery of the order of Calatrava. Here is a very remarkable fountain, which throws up water through 42 pipes. It is surrounded with gardens and fruit trees, and defended by a good fortress. W. Long. 0. 5. N. Lat. 41. 0.

ALCANNA, or ALKANNA, in Commerce, a powder prepared from the leaves of the Egyptian privet, in which the people of Cairo drive a considerable trade. It is much used by the Turkish women to give a golden colour to their nails and hair. In dyeing, it gives a yellow colour when steeped with common water, and a red one when infused in vinegar. There is also an

oil extracted from the berries of alcanna, which is sometimes used in medicine.

ALCANTARA, a small, but very strong city of Estremadura, in Spain, with a population of 3000. It gives name to one of the three orders of knighthood. It is seated on the banks of the Tajo or Tagus, 21 miles from Coria, in a very fruitful soil, and is celebrated for its bridge over that river. This was built in the time of the emperor Trajan, as appears by an inscription over one of the arches, by the people of Lusitania, who were assessed to supply the expence. It is raised 200 feet above the level of the water; and though it consists but of six arches, is 670 feet in length, and 28 in breadth. At the entrance of the bridge, there is a small antique chapel hewn in a rock by the ancient Pagans, who dedicated it to Trajan, as the Christians did to St Julian. This city was built by the Moors, on account of the convenience of this bridge; which is at a place where the Tajo is very deep, running between two high steep rocks: for this reason they called it *Al-Cantara*, which in their language signifies *the Bridge*. It was taken from them in 1214, and given to the knights of *Calatrava*, who afterwards assumed the name of *Alcantara*. It was taken by the earl of Galway, in April 1706, and retaken by the French in November following. It is 45 miles from Madrid, and 125 from Seville. W. Long. 7. 12. N. Lat. 39. 30.

Knights of ALCANTARA, a military order of Spain, which took its name from the above-mentioned city. They make a very considerable figure in the history of the expeditions against the Moors. The knights of Alcantara make the same vows as those of Calatrava, and are only distinguished from them by this, that the cross fleur de lys, which they bear over a large white cloak, is of a green colour. They possess 37 commanderies. By the terms of the surrender of Alcantara to this order, it was stipulated, that there should be a confraternity between the two orders, with the same practices and observances in both; and that the order of Alcantara should be subject to be visited by the grand-master of Calatrava. But the former soon released themselves from this engagement, on pretence that their grand-master had not been called to the election of that of Calatrava, as had been likewise stipulated in the articles. After the expulsion of the Moors, and the taking of Granada, the sovereignty of the order of Alcantara and that of Calatrava was settled in the crown of Castile by Ferdinand and Isabella.—In 1540, the knights of Alcantara sued for leave to marry, which was granted them.

ALCAREZ, a small city of La Mancha in Spain, defended by a pretty strong castle, and remarkable for an ancient aqueduct. It stands near the river Guardamena, and the soil about it is very fruitful. They have a breed of little running horses, which are very fleet and strong. It is 25 miles north of the confines of Andalusia, 108 south of Cuenza, and 138 south by east of Madrid. W. Long. 2. 45. N. Lat. 38. 56.

ALCASSAR DO SAL, a town of Portugal, in Estremadura, which has a castle said to be impregnable. It is indeed very strong, both by art and nature, being built on the top of a rock which is exceedingly steep on all sides. Here is a salt-work, which produces very white salt, from whence the town takes its name. The

Alcanna

Alcassar.

Alcassar.

Alcassaf
||
Alcazar.

fields produce large quantities of a sort of rushes, of which they make mats, which are transported out of the kingdom. W. Long. 9. 10. N. Lat. 38. 18.

ALCASSAR, a city of Barbary, seated about two leagues from Larache, in Asga, a province of the kingdom of Fez. It was of great note, and the seat of the governor of this part of the kingdom. It was built by Jacob Almanzor, king of Fez, about the year 1180, and designed for a magazine and place of rendezvous for the great preparations he was making to enter Granada in Spain, and to make good the footing Joseph Almanzor had got some time before. It is said his father first invaded Spain with 300,000 men, most of whom he was obliged to bring back to Africa to quell a rebellion that had broke out in Morocco. This done, he returned to Spain again with an army, as is said, of 200,000 horse and 300,000 foot. The city is now fallen greatly to decay, so that of fifteen mosques there are only two that they make use of. The reason, probably, is the bad situation of the town; for it stands so low, that it is excessively hot in summer, and almost overflowed with water in the winter. This they affirm to be owing to the curse of one of their saints. Here are a great number of storks, who live very familiarly with the people, walking about the town, possessing the tops of the houses and mosques without molestation; for they esteem them sacred birds, and account it sinful to disturb them. At present, the bashaw of Tetuan appoints a governor to this town, which is the last of his dominions towards Mequinez. Near this city there is a high ridge of mountains, running towards Tetuan, whose inhabitants were never brought entirely under subjection; and whenever it was attempted, they revenged themselves by infesting the roads, and robbing and destroying the travellers. When they were pursued, they retired into their woody mountains, where none could safely follow them. Not far from hence is the river Elmahassen, famous for the battle fought between Don Sebastian king of Portugal and the Moors; in which the Portuguese were defeated, and their king slain. W. Long. 12. 35. N. Lat. 35. 15.

ALCAVALA, in the Spanish finances, was at first a tax of ten per cent. afterwards of 14 per cent. and is at present of only 6 per cent. upon the sale of every sort of property, whether moveable or immoveable; and it is repeated every time the property is sold. The levying of this tax requires a multitude of revenue officers sufficient to guard the transportation of goods, not only from one province to another, but from one shop to another. It subjects not only the dealers in some sort of goods, but those in all sorts, every farmer, every manufacturer, every merchant and shopkeeper, to the continual visits and examination of the tax-gatherers. Through the greater part of a country in which a tax of this kind is established, nothing can be produced for distant sale. The produce of every part of the country must be proportioned to the consumption of the neighbourhood. It is to the Alcavala, accordingly, that Ustaritz imputes the ruin of the manufactures of Spain. He might have imputed to it likewise the declension of agriculture, it being imposed not only upon manufactures, but upon the rude produce of the land.

ALCAZAR LEGUER, a town of Africa, in the kingdom of Fez, and in the province of Ilabat. It

was taken by Alphonso, king of Portugal, in 1468; but soon after that it was abandoned to the Moors. It is seated on the coast of the straits of Gibraltar. W. Long. 3. 50. N. Lat. 38. 0.

ALCAZER, a town of Spain, in New Castile, seated on the river Guardamena, which has a fortress on a high hill for its defence, and lies in a very fruitful country. It is 100 miles north-west of Carthage. W. Long. 2. 10. N. Lat. 38. 15.

ALCE, ALCES, or ELK, in *Zoology*, the trivial name of a species of the cervus, belonging to the order of mammalia pecora. See CERVUS.

ALCEA, the HOLLY-HOCK. See BOTANY Index.

ALCEDO, or KINGFISHER. See ORNITHOLOGY Index.

ALCHEMILLA, or LADIES-MANTLE. See BOTANY Index.

ALCHEMIST, a practitioner in alchemy.

ALCHEMY, that branch of chemistry which had for its principal objects the transmutation of metals into gold; the panacea, or universal remedy; an alkahest, or universal menstruum; an universal ferment; and many other things equally ridiculous.

Kircher, instructed in all the secrets of chemistry, has fully exposed the artifices and impostures of alchemists. An alchemist puts into a crucible the matter which is to be converted into gold: this he sets on the fire, blows it, stirs it with rods; and, after divers operations, gold is found at the bottom of the crucible, instead of the matter first put in. This there are a thousand ways of effecting, without any transmutation. Sometimes it is done by dexterously dropping in a piece of gold concealed between the fingers; sometimes by casting in a little of the dust of gold or silver disguised under the appearance of some elixir, or other indifferent matter; sometimes a crucible is used which has a double bottom, and gold put between the two; sometimes the rod used to stir the matter is hollow, and filled with the dust of the metal desired; at other times there is metal mixed with the charcoal, the ashes of the furnace, or the like. Mr Harris very properly distinguishes alchemy from chemistry; and defines the former to be *ars sine arte, cujus principium est mentiri, medium laborare, et finis mendicare*; and the Italians have a proverb, *non ti fidare al alchemista povero o medico amalato*. The ruin which has attended this delusion has occasioned several states to make severe laws against pretences to alchemy. The Romans formerly banished all such as professed it; and the sacred canons likewise directed the thunder of their censure against them. Dioclesian and Cæsar directed all books which treated of this subject to be burnt. Rymer furnishes us with a license for practising alchemy, with all kinds of metals and minerals, granted to one Richard Carter in 1476; *Rym. Fæd.* tom. xii. Nevertheless, we have had severe laws against alchemy, and multiplying of metals, as much so as against coining itself.

ALCHORNEA. See BOTANY Index.

ALCIAT or ALCIATE, ANDREW, a great lawyer, who flourished in the tenth century, was born at Milan. He mixed much of polite learning in the explication of the laws, and happily drove out the barbarity of language which till then had reigned in the lectures and writings of lawyers; for which Thuanus highly praises

Alcaza
||
Alciat

praises him. He published a great many law-books, and some notes upon Tacitus. His Emblems have been much admired, and translated into French, Italian and Spanish; and several learned men have written commentaries on them.

ALCIBIADES, an Athenian general. It was the fate of this great man to live at a time when his country was a scene of confusion. The Greeks, grown insolent from their conquests in Persia, turned their armies against each other, and banded together under the conduct of the two most opulent states, Athens and Lacedæmon. Alcibiades, in the midst of an expedition he had planned against the enemies of his country, was recalled home to answer some charge of a private nature; but fearing the violence of his enemy, instead of going to Athens, he offered his services at Sparta, where they were readily accepted. By his advice the Lacedæmonians made a league with Persia, which gave a very favourable turn to their affairs. But his credit in the republic raising jealousies against him, he privately reconciled himself to his country, and took again the command of the Athenian army. Here victory, waiting as it were at his command, attended all his motions. The loss of seven battles obliged the Spartans to sue for peace. He enjoyed his triumphs, however, only a short time at Athens. One unsuccessful event made him again obnoxious to the malice of his citizens; and he found it expedient to retire from Athens. In his absence the Spartans again took the lead, and at the fatal battle of Ægos entirely subdued the Athenian power. Alcibiades, though an exile, endeavoured to restore the power of his country; of which the Spartans having intelligence, procured him to be assassinated. He was a man of admirable accomplishments, but indifferently principled; of great parts; and of an amazing versatility of genius.

ALCINOUS, king of the Phæacians, in the island now called Corfu, was son of Nausithous, and grandson of Neptune and Peribea. It is by his gardens this king has chiefly immortalized his memory. He received Ulysses with much civility, when a storm had cast him on his coast. The people here loved pleasure and good cheer, yet were skilful seamen; and Alcinoüs was a good prince.

ALCMAER, a city of the United Provinces, seated in North Holland, about four miles from the sea, 15 from Haerlem, and 18 from Amsterdam. It is a handsome city, and contained above 8000 inhabitants in 1796. The streets and houses are extremely neat and regular, and the public buildings very beautiful. It had formerly two parish churches, dedicated to St Matthew and St Lawrence. The latter had so high a tower, that it served for a sea-mark to the vessels that were in the open sea; but, in 1464, it tumbled down, and damaged the other church so much, that they were both demolished in 1670, and one church was built in their stead, dedicated to the same saints. The Spaniards, under the command of Frederick of Toledo, son of the duke of Alva, came to besiege it, after they had taken Haerlem in 1573; but were forced to raise the siege after lying three months before it, as well on account of the infection of the air as the stout resistance of the inhabitants and soldiers; even the women signaling themselves bravely in its defence. It is recorded in the register of this city, that, in the year 1637, 120

tulips, with the offsets, sold for 90,000 florins. The town has a very great trade in butter and cheese. It was taken by the British in 1799, but soon abandoned. E. Long. 4. 26. N. Lat. 52. 28.

ALCMAN, a lyric poet, who flourished in the 27th Olympiad, about 670 years before Christ. He was born at Sparta; and composed several poems, of which only some fragments are remaining, quoted by Athenæus and some other ancient writers. He was very amorous; accounted the father of gallant poesy; and is said to have been the first that introduced the custom of singing love songs in company. He is reported to have been one of the greatest orators of his age; upon which Mr Bayle remarks, that such a quality would have been extremely inconvenient, if poetry had been at that time upon such a footing as it has been often since, not able to procure the poet bread. He died of a strange disease; for he was eaten up with lice.

ALCMANIAN, in ancient lyric poetry, a kind of verse, consisting of two dactyles and two trochees: as,—

Virgini|bus pue|risque|canto.

The word is formed from *Alcman*, the name of an ancient Greek poet, in great esteem for his erotics or amorous compositions.

ALCMENA, the daughter of Electryo king of Mycenæ, and wife of Amphitryon. Jupiter putting on the shape of her husband while he was abroad in the wars, begot Hercules upon her: he made that night as long as three ordinary ones.

ALCOCK, John, doctor of laws, and bishop of Ely, in the reign of King Henry VII. was born at Beverly in Yorkshire, and educated at Cambridge. He was first made dean of Westminster, and afterwards appointed master of the rolls. In 1471, he was consecrated bishop of Rochester: in 1476, he was translated to the see of Worcester; and in 1486, to that of Ely, in the room of Dr John Morton, preferred to the see of Canterbury. He was a prelate of great learning and piety, and so highly esteemed by King Henry, that he appointed him lord president of Wales, and afterwards lord chancellor of England. Alcock founded a school at Kingston upon Hull, and built the spacious hall belonging to the episcopal palace at Ely. He was also the founder of Jesus-college in Cambridge, for a master, six fellows, and as many scholars. This house was formerly a nunnery, dedicated to St Radigund; and, as Godwin tells us, the building being greatly decayed, and the revenues reduced almost to nothing, the nuns had all forsaken it, except two; whereupon Bishop Alcock procured a grant from the crown, and converted it into a college. But Camden and others tell us, that the nuns of that house were so notorious for their incontinence, that King Henry VII. and Pope Julius II. consented to its dissolution: Bale accordingly calls this nunnery *spiritualium meretricum cœnobium*, "a community of spiritual harlots." Bishop Alcock wrote several pieces; among which are the following: 1. *Mons Perfectionis*. 2. *In Psalmos Penitentiales*. 3. *Homiliæ Vulgares*. 4. *Meditationes Piæ*. He died October 1. 1500; and was buried in the chapel he had built at Kingston upon Hull.

ALCOHOL, or **ALKOOL**, in *Chemistry*, spirit of wine highly rectified. It is also used for any highly rectified

Alemaer
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Alecohol.

Alcohol
||
Alcoran.

rectified spirit.—Alcohol is extremely light and inflammable: it is a strong antiseptic, and therefore employed to preserve animal substances. See *CHEMISTRY Index*.

ALCOHOL is also used for any fine impalpable powder.

ALCOHOLIZATION, the process of rectifying any spirit. It is also used for pulverization.

ALCOR, in *Astronomy*, a small star adjoining to the large bright one in the middle of the tail of *ursa major*.—The word is Arabic. It is a proverb among the Arabians, applied to one who pretends to see small things, but overlooks much greater: *Thou canst see Alcor, and yet not see the full moon*.

ALCORAN, or AL-KORAN, the scripture or bible of the Mahometans. The word is compounded of the Arabic particle *al*, and *coran* or *koran*, derived from the verb *caraa* or *karaa*, to read. The word therefore properly signifies, *the reading*; or rather, *that which ought to be read*. By this name the Mahometans denote not only the entire book or volume of the Koran, but also any particular chapter or section of it; just as the Jews call either the whole Scripture, or any part of it, by the name of *Karah*, or *Mikra*, words of the same origin and import.

Besides this peculiar name, the Koran is also honoured with several appellations common to other books of Scripture: as, *al Farkan*, from the verb *foraka*, to divide or distinguish; not, as the Mahometan doctors say, because those books are divided into chapters or sections, or distinguish between good and evil; but in the same notion that the Jews use the word *Perek*, or *Pirka*, from the same root, to denote a section or portion of Scripture. It is also called *al Moshaf*, *the volume*, and *al Kiah*, *the book*, by way of eminence, which answers to the *Biblia* of the Greeks; and *al Dhikr*, *the admonition*, which name is also given to the Pentateuch and Gospel.

The Koran is divided into 114 larger portions of very unequal length, which we call *chapters*; but the Arabians *sowar*, in the singular *sura*, a word rarely used on any other occasion, and properly signifying a row, order, or a regular series; as a course of bricks in a building, or a rank of soldiers in an army; and is the same in use and import with the *Sura*, or *Tora*, of the Jews, who also call the fifty-three sections of the Pentateuch *Sedarim*, a word of the same signification.

These chapters are not, in the manuscript copies, distinguished by their numerical order, but by particular titles, which are taken sometimes from a particular matter treated of, or person mentioned therein; but usually from the first word of note, exactly in the same manner as the Jews have named their *Sedarim*; though the word from which some chapters are denominated be very far distant, towards the middle, or perhaps the end of the chapter; which seems ridiculous. But the occasion of this appears to have been, that the verse or passage wherein such word occurs, was, in the point of time, revealed and committed to writing before the other verses of the same chapter, which precede it in order; and the title being given to the chapter before it was completed, or the passages reduced to their present order; the verse from whence such title was taken did not always happen to begin the chapter. Some chap-

ters have two or more titles, occasioned by the difference of the copies.

Some of the chapters having been revealed at Mecca, and others at Medina, the noting this difference makes a part of the title: but the reader will observe, that several of the chapters are said to have been revealed partly at Mecca and partly at Medina; and, as to others, it is yet a dispute among the commentators to which of the two places they belong.

Every chapter is subdivided into smaller portions, of very unequal length also, which we customarily call *verses*; but the Arabic word is *ayat*, the same with the Hebrew *ototh*, and signifies *signs* or *wonders*: such as are the secrets of God, his attributes, works, judgments, and ordinances, delivered in those verses; many of which have their particular titles also, imposed in the same manner as those of the chapters.

Besides these unequal divisions of chapter and verse, the Mahometans have also divided their Koran into sixteen equal portions, which they call *Ahzab*, in the singular *Hizb*, each divided into four equal parts; which is also an imitation of the Jews, who have an ancient division of their Mishna into sixty portions called *Masicoth*. But the Koran is more usually divided into thirty sections only, named *Ajza*, from the singular *Joz*, each of twice the length of the former, and in the like manner subdivided into four parts. These divisions are for the use of the readers of the Koran in the royal temples, or in the adjoining chapels where the emperors and great men are interred. There are thirty of these readers belonging to every chapel, and each reads his section every day; so that the whole Koran is read over once a day.

Next after the title, at the head of every chapter, except only the ninth, is prefixed the following solemn form, by the Mahometans called the *Bismallah*, IN THE NAME OF THE MOST MERCIFUL GOD; which form they constantly place at the beginning of all their books and writings in general, as a peculiar mark or distinguishing characteristic of their religion, it being counted a sort of impiety to omit it. The Jews, for the same purpose, make use of the form, *In the name of the LORD*, or, *In the name of the great GOD*; and the eastern Christians that of, *In the name of the Father, and of the Son, and of the Holy Ghost*. But Mahomet probably took this form, as he did many other things, from the Persian Magi, who used to begin their books in these words, *Benam Yezdan bakshaishgher dadar*; that is, *In the name of the most merciful just GOD*.

There are twenty-nine chapters of the Koran, which have this peculiarity, that they begin with certain letters of the alphabet, some with a single one, others with more. These letters the Mahometans believe to be the peculiar marks of the Koran, and to conceal several profound mysteries; the certain understanding of which, the most intelligent confess, has not been communicated to any mortal, their prophet only excepted. Notwithstanding which, some will take the liberty of guessing at their meaning by that species of Cabala called by the Jews *Notarikon*, and suppose the letters to stand for as many words, expressing the names and attributes of God, his works, ordinances, and decrees; and therefore these mysterious letters, as well as the

verses

Alcoran. verses themselves, seem in the Koran to be called *signs*. Others explain the intent of these letters from their nature or organ, or else from their value in numbers, according to another species of the Jewish Cabala called *Gematria*; the uncertainty of which conjectures sufficiently appears from their disagreement. Thus, for example, five chapters, one of which is the second, begin with these letters, A. L. M. which some imagine to stand for *Allah latiff magid*, "God is gracious and to be glorified"; or, *Ana li minni*, i. e. to me and from me, viz. belongs all perfection, and proceeds all good; or else for *Ana Allah alam*, "I am the most wise God," taking the first letter to mark the beginning of the first word, the second the middle of the second word, and the third the last of the third word; or for *Allah, Gabriel, Mohammed*, the author, revealer, and preacher of the Koran. Others say, that as the letter A belongs to the lower part of the throat, the first of the organs of speech; L to the palate, the middle organ; and M to the lips, which are the last organ; so these letters signify that God is the beginning, middle, and end, or ought to be praised in the beginning, middle, and end, of all our words and actions: or, as the total value of those three letters, in numbers, is seventy-one, they signify, that, in the space of so many years, the religion preached in the Koran should be fully established. The conjecture of a learned Christian is at least as certain as any of the former, who supposes those letters were set there by the amanuensis, for *Amar li Mohammed*, i. e. at the command of Mohammed, as the five letters prefixed to the nineteenth chapter seem to be there written by a Jewish scribe, for *Coh yaas*, Thus he commanded.

The Koran is universally allowed to be written with the utmost elegance and purity of language, in the dialect of the tribe of Koreish, the most noble and polite of all the Arabians, but with some mixture, though very rarely, of other dialects. It is confessedly the standard of the Arabic tongue, and, as the more orthodox believe, and are taught by the book itself, inimitable by any human pen (though some sectaries have been of another opinion), and therefore insisted on as a permanent miracle, greater than that of raising the dead, and alone sufficient to convince the world of its divine original.

And to this miracle did Mahomet himself chiefly appeal for the confirmation of his mission, publicly challenging the most eloquent men in Arabia, which was at that time stocked with thousands whose sole study and ambition it was to excel in elegance of style and composition, to produce even a single chapter that might be compared with it (A.)

To the pomp and harmony of expression some ascribe all the force and effect of the Alcoran; which they consider as a sort of music, equally fitted with other species of that art to ravish and amaze. In this Mahomet succeeded so well, and so strangely captivated the minds of his audience, that several of his opponents thought

Alcoran. it the effect of witchcraft and enchantment, as he himself complains.—Others have attributed the effect of the Alcoran to the frequent mention of rewards and punishments; heaven and hell occurring almost in every page. Some suppose, that the sensual pleasures of paradise, so frequently set before the imaginations of the readers of the Alcoran, were what chiefly bewitched them. Though, with regard to these, there is a great dispute whether they are to be understood literally or spiritually. Several have even allegorized the whole book.

The general design of the Koran was to unite the professors of the three different religions, then followed in the populous country of Arabia (who for the most part lived promiscuously, and wandered without guides, the far greater number being idolaters, and the rest Jews and Christians mostly of erroneous and heterodox belief), in the knowledge and worship of one God, under the sanction of certain laws, and the outward signs of ceremonies partly of ancient and partly of novel institution, enforced by the consideration of rewards and punishments both temporal and eternal; and to bring them all to the obedience of Mahomet, as the prophet and ambassador of God, who, after the repeated admonitions, promises, and threats, of former ages, was at last to establish and propagate God's religion on earth, and to be acknowledged chief pontiff in spiritual matters, as well as supreme prince in temporal.

The great doctrine then of the Koran, is the unity of God; to restore which point Mahomet pretended was the chief end of his mission; it being laid down by him as a fundamental truth, That there never was, nor ever can be, more than one true orthodox religion. For, though the particular laws or ceremonies are only temporary, and subject to alteration, according to the divine directions; yet the substance of it being eternal truth, is not liable to change, but continues immutably the same. And he taught, that, whenever this religion became neglected, or corrupted in essentials, God had the goodness to re-inform and re-admonish mankind thereof, by several prophets, of whom Moses and Jesus were the most distinguished, till the appearance of Mahomet, who is their seal, and no other to be expected after him. The more effectually to engage people to hearken to him, great part of the Koran is employed in relating examples of dreadful punishments formerly inflicted by God on those who rejected and abused his messengers; several of which stories, or some circumstances of them, are taken from the Old and New Testaments, but many more from the apocryphal books and traditions of the Jews and Christians of those ages, set up in the Koran as truths in opposition to the Scriptures, which the Jews and Christians are charged with having altered; and indeed, few or none of the relations or circumstances in the Koran were invented by Mahomet, as is generally supposed, it being easy to trace the greatest part of them.

(A) As the composition and arrangement of words, however, admit of infinite varieties, it can never be absolutely said that any one is the best possible. In fact, Hamzah Benahmed wrote a book against the Alcoran with at least equal elegance; and Moselema another, which even surpassed it, and occasioned a defection of a great part of the Mussulmans. *Journ. de Scav. tom. xiii. p. 280. Oeuvr. de Scav. Nov. 1708. p. 404.*

Alcoran. them much higher, as the rest might be, were more of those books extant, and was it worth while to make the inquiry.

The rest of the *Alcoran* is taken up in prescribing necessary laws and directions, frequent admonitions to moral and divine virtues, the worship and reverence of the Supreme Being, and resignation to his will. One of their most learned commentators distinguishes the contents of the *Alcoran* into *allegorical* and *literal*: under the former are comprehended all the obscure, paradoxical, and enigmatical passages, with such as are repealed, or abrogated; the latter, such as are clear, and in full force.

The most excellent moral in the whole *Alcoran*, interpreters say, is that in the chapter *Al Araf*, viz. "Shew mercy, do good to all, and dispute not with the ignorant;" or, as Mr Sale renders it, "Use indulgence, command that which is just, and withdraw far from the ignorant." Mahomet, according to the authors of the *Keschaf*, having begged of the angel Gabriel a more ample explication of this passage, received it in the following terms: "Seek him who turns thee out, give to him who takes from thee, pardon him who injures thee; for God will have you plant in your souls the roots of his chief perfections." It is easy to see that this commentary is copied from the gospel. In reality, the necessity of forgiving enemies, though frequently inculcated in the *Alcoran*, is of a later date among the Mahometans than among the Christians; among those latter, than among the heathens; and to be traced originally among the Jews. (See *EXODUS* xxxiii. 4. 5.). But it matters not so much who had it first, as who observes it best. The caliph Hassan, son of Hali, being at table, a slave unfortunately let fall a dish of meat reeking hot, which scalded him severely. The slave fell on his knees, rehearsing these words of the *Alcoran*, "Paradise is for those, who restrain their anger." I am not angry with thee, answered the caliph—"And for those who forgive offences against them," continues the slave. I forgive thee thine, replies the caliph—"But above all, for those who return good for evil," adds the slave. I set thee at liberty, rejoined the caliph; and I give thee ten dinars.

There are also a great number of occasional passages in the *Alcoran*, relating only to particular emergencies. For this advantage Mahomet had in the piecemeal method of receiving his revelation, that whenever he happened to be perplexed and gravelled with any thing, he had a certain resource in some new morsel of revelation. It was an admirable contrivance of his, to bring down the whole *Alcoran* at once, only to the lowest heaven, not to earth; since, had the whole been published at once, innumerable objections would have been made, which it would have been impossible for him to solve; but as he received it by parcels, as God saw fit they should be published for the conversion and instruction of the people, he had a sure way to answer all emergencies, and to extricate himself with honour from any difficulty which might occur.

It is the general and orthodox belief among the Mahometans, that the *Koran* is of divine original; nay, that it is eternal and uncreated, remaining, as some express it, in the very essence of God: that the first transcript has been from everlasting by God's throne, written on a table of vast bigness, called the *preserved*

table, in which are also recorded the divine decrees past and future: that a copy from this table, in one volume on paper, was by the ministry of the angel Gabriel sent down to the lowest heaven, in the month of Ramadan, on the night of *power*: from whence Gabriel revealed it to Mahomet by parcels, some at Mecca, and some at Medina, at different times, during the space of 23 years, as the exigency of affairs required; giving him, however, the consolation to show him the whole (which they tell us was bound in silk, and adorned with gold and precious stones of paradise) once a year; but in the last year of his life he had the favour to see it twice. They say, that few chapters were delivered entire, the most part being revealed piecemeal, and written down from time to time by the prophet's amanuensis in such a part of such and such a chapter till they were completed, according to the directions of the angel. The first parcel that was revealed is generally agreed to have been the first five verses of the 46th chapter.

After the new-revealed passages had been from the prophet's mouth taken down in writing by his scribe, they were published to his followers; several of whom took copies for their private use, but the far greater number got them by heart. The originals, when returned, were put promiscuously into a chest, observing no order of time; for which reason it is uncertain when many passages were revealed.

When Mahomet died, he left his revelations in the same disorder, and not digested into the method, such as it is, in which we now find them. This was the work of his successor Abu Becr; who, considering that a great number of passages were committed to the memory of Mahomet's followers, many of whom were slain in their wars, ordered the whole to be collected, not only from the palm leaves and skins on which they had been written, and which were kept between two boards or covers, but also from the mouths of such as had gotten them by heart. And this transcript, when completed, he committed to the custody of Hassa the daughter of Omar, one of the prophet's widows.

From this relation it is generally imagined that Abu Becr was really the compiler of the *Koran*; though, for aught appears to the contrary, Mahomet left the chapters complete as we now have them, excepting such passages as his successor might add or correct from those who had gotten them by heart; what Abu Becr did else, being perhaps no more than to range the chapters in their present order, which he seems to have done without any regard to time, having generally placed the longest first.

However, in the 30th year of the Hegira, Othman being then caliph, and observing the great disagreement in the copies of the *Koran* in the several provinces of the empire; those of Irak, for example, following the reading of Abu Musa al Ashari, and the Syrians that of Maedad Ebn Aswad; he, by the advice of the *companions*, ordered a great number of copies to be transcribed from that of Abu Becr, in Hassa's care, under the inspection of Zeid Ebn Thabet, Abd'allah Ebn Zobair, Said Ebn al As, and Abd'alrahman Ebn al Hareth the Makhzumite; whom he directed, that, wherever they disagreed about any word, they should write it in the dialect of the Korish,

Alcoran. reish, in which it was at first delivered. These copies, when made, were dispersed in the several provinces of the empire, and the old ones burnt and suppressed. Though many things in Hassa's copy were corrected by the above-mentioned revisers, yet some few various readings still occur.

In fine, the book of the Alcoran is held in the highest esteem and reverence among the Mussulmans. They dare not so much as touch the Alcoran without being first washed, or legally purified; to prevent which, an inscription is put on the cover or label, *Let none touch but they who are clean*. It is read with great care and respect; being never held below the girdle. They swear by it; take omens from it on all weighty occasions; carry it with them to war; write sentences of it in their banners; adorn it with gold and precious stones; and knowingly suffer it not to be in the possession of any of a different religion. Some say that it is punishable even with death, in a Christian, to touch it; others, that the veneration of the Mussulmans leads them to condemn the translating it into any other language as a profanation: but these seem to be aggravations. The Mahometans have taken care to have their Scripture translated into the Persian, the Javanese, the Malayan, and other languages; though, out of respect to the original, these versions are generally, if not always, interlineated.

View of
Christiani-
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Mahome-
anism,
257.

By the advocates of Mahometanism, the Koran, as already observed, has always been held forth as the greatest of miracles, and equally stupendous with the act of raising the dead. The miracles of Moses and Jesus, they say, were transient and temporary; but that of the Koran is permanent and perpetual; and therefore far surpasses all the miraculous events of preceding ages. We will not detract from the real merit of the Koran: we allow it to be generally elegant, and often sublime: but at the same time we reject with disdain its arrogant pretence to any thing supernatural; all the real excellence of the work being easily referable to natural and visible causes.

"In the language of Arabia, a language extremely loved and diligently cultivated by the people to whom it was vernacular, Mahomet found advantages which were never enjoyed by any former or succeeding impostor. It requires not the eye of a philosopher to discover in every soil and country a principle of national pride: and if we look back for many ages on the history of the Arabians, we shall easily perceive that pride among them invariably to have consisted in the knowledge and improvement of their native language. The Arabic, which has been justly esteemed the most copious of the Eastern tongues; which had existed from the remotest antiquity; which had been embellished by numberless poets, and refined by the constant exercise of the natives; was the most successful instrument which Mahomet employed in planting his new religion among them. Admirably adapted by its unrivalled harmony, and by its endless variety, to add painting to expression, and to pursue the imagination in its unbounded flight; it became in the hands of Mahomet an irresistible charm to blind the judgment, and to captivate the fancy of his followers.

"Of that description of men, who first composed the adherents of Mahomet, and to whom the Koran was addressed, few, probably, were able to pass a very ac-

curate judgment on the propriety of the sentiments, or on the beauties of the diction: but all could judge of the military abilities of their leader; and in the midst of their admiration it is not difficult to conceive, that they would ascribe to his compositions every imaginary beauty of inspired language.

"The shepherd and the soldier, though awake to the charms of those wild but beautiful compositions, in which were celebrated their favourite occupations of love or war, were yet little able to criticise any other works than those which were addressed to the imagination or the heart. To abstract reasonings on the attributes and the dispensations of the Deity, to the comparative excellencies of rival religions, to the consistency of any one religious system in all its parts, and to the force of its various proofs, they were quite inattentive. In such a situation, the appearance of a work which possessed something like wisdom and consistence; which prescribed the rules, and illustrated the duties of life; and which contained the principles of a new and comparatively sublime theology, independently of its real and permanent merit, was likely to excite their astonishment, and to become the standard of future composition.

"In the first periods of the literature of every country, something of this kind has happened. The father of Grecian poetry very obviously influenced the taste and imitation of his countrymen. The modern nations of Europe all possess some original author, who, rising from the darkness of former ages, has begun the career of composition, and tinctured with the character of his own imagination the stream which has flowed through his posterity.

"But the prophet of Arabia had in this respect advantages peculiar to himself. His compositions were not to his followers the works of man, but the genuine language of Heaven, which had sent him. They were not confined therefore to that admiration which is so liberally bestowed on the earliest productions of genius, or to that fond attachment with which men everywhere regard the original compositions of their country: but with their admiration they blended their piety. To know and to feel the beauties of the Koran, was in some respect to share in the temper of heaven; and he who was most affected with admiration in the perusal of its beauties, seemed most fitly the object of that mercy which had given it to ignorant man. The Koran, therefore, became naturally and necessarily the standard of taste. With a language thus hallowed in their imaginations, they were too well satisfied, either to dispute its elegance or improve its structure. In succeeding ages, the additional sanction of antiquity, or prescription, was given to these compositions which their fathers had admired: and while the belief of its divine original continues, that admiration, which has thus become the test and the duty of the faithful, can neither be altered nor diminished.

"When therefore we consider these peculiar advantages of the Koran, we have no reason to be surprised at the admiration in which it is held. But if, descending to a more minute investigation of it, we consider its perpetual inconsistency and absurdity, we shall indeed have cause for astonishment at that weakness of humanity which could ever have received such compositions as the work of the Deity.

Alcoran.

"The first praise of all the productions of genius, is invention; that quality of the mind, which, by the extent and quickness of its views, is capable of the largest conceptions, and of forming new combinations of objects the most distant and unusual. But the Koran bears little impression of this transcendent character. Its materials are wholly borrowed from the Jewish and Christian Scriptures, from the Talmudical legends and apocryphal gospels then current in the East, and from the traditions and fables which abounded in Arabia. The materials collected from these several sources are here heaped together with perpetual and needless repetitions, without any settled principle or visible connection.

"When a great part of the life of Mahomet had been spent in preparatory meditation on the system he was about to establish, its chapters were dealt out slowly and separately during the long period of 23 years. Yet thus defective in its structure, and not less exceptionable in its doctrines, was the work which Mahomet delivered to his followers as the oracles of God.

"The most prominent feature of the Koran, that point of excellence in which the partiality of its admirers has ever delighted to view it, is the sublime notion it generally impresses of the nature and attributes of God. If its author had really derived these just conceptions from the inspiration of that Being whom they attempt to describe, they would not have been surrounded, as they now are on every side, with error and absurdity. But it might easily be proved, that whatever it justly defines of the divine attributes, was borrowed from our Holy Scripture; which even from its first promulgation, but especially from the completion of the New Testament, has extended the views and enlightened the understandings of mankind; and thus furnished them with arms, which have too often, though ineffectually, been turned against itself by its ungenerous enemies.

"In this instance particularly, the copy is far below the great original, both in the propriety of its images, and the force of its descriptions. Our Holy Scriptures are the only compositions that can enable the dim sight of mortality to penetrate into the invisible world, and to behold a glimpse of the Divine perfections. Accordingly, when they would represent to us the happiness of Heaven, they describe it, not by any thing minute and particular, but by something general and great: something that, without descending to any determinate object, may at once by its beauty and immensity excite our wishes and elevate our affections. Though in the prophetic and evangelical writings the joys that shall attend us in a future state are often mentioned with ardent admiration, they are expressed rather by allusion than similitude, rather by indefinite and figurative terms, than by any thing fixed and determinate. "Eye hath not seen, nor ear heard, neither have entered into the heart of man, the things which God hath prepared for them that love him." 1 Cor. ii. 9. What a reverence and astonishment does this passage excite in every hearer of taste and piety! What energy, and at the same time what simplicity, in the expression! How sublime, and at the same time how obscure, is the imagery!

"Different was the conduct of Mahomet in his descriptions of heaven and of paradise. Unassisted by the

Alcoran.

necessary influence of virtuous intentions and Divine inspiration, he was neither desirous, nor indeed able, to exalt the minds of men to sublime conceptions, or to rational expectations. By attempting to explain what is inconceivable, to describe what is ineffable, and to materialize what in itself is spiritual; he absurdly and impiously aimed to sensualize the purity of the Divine essence. Thus he fabricated a system of incoherence, a religion of depravity, totally repugnant indeed to the nature of that Being, who, as he pretended, was its object; but therefore more likely to accord with the appetites and conceptions of a corrupt and sensual age.

"That we may not appear to exalt our Scriptures thus far above the Koran by an unreasonable preference, we shall produce a part of the second chapter of the latter, which is deservedly admired by the Mahometans, who wear it engraved on their ornaments, and recite it in their prayers. 'God! there is no God but he; the living, the self-subsisting: neither slumber nor sleep seizeth on him: to him belongeth whatsoever is in heaven, and on earth. Who is he that can intercede with him but through his good pleasure? He knoweth that which is past, and that which is to come. His throne is extended over heaven and earth, and the preservation of both is to him no burden. He is the high, the mighty.' *Salé's Kor.* ii. p. 30. 4to edit.

"To this description who can refuse the praise of magnificence? Part of that magnificence, however, is to be referred to that verse of the Psalmist, whence it was borrowed, 'He that keepeth Israel, shall neither slumber nor sleep.' *Psal.* cxxi. 4.

"But if we compare it with that other passage of the same inspired Psalmist, all its boasted grandeur is at once obscured, and lost in the blaze of a greater light.

"O my God, take me not away in the midst of my days; thy years are throughout all generations. Of old hast thou laid the foundations of the earth; and the heavens are the work of thy hands. They shall perish, but thou shalt endure: yea all of them shall wax old, as doth a garment; as a vesture shalt thou change them, and they shall be changed; but thou art the same, and thy years shall not fail."

"The Koran, therefore, upon a retrospective view of these several circumstances, far from supporting its arrogant claim to a supernatural work, sinks below the level of many compositions confessedly of human origin; and still lower does it fall in our estimation, when compared with that pure and perfect pattern which we justly admire in the Scriptures of truth.

"It is therefore abundantly apparent, that no miracle either was externally performed for the support, or is internally involved in the composition, of the Mahometan revelation."

ALCORAN, is also figuratively applied to certain other books full of impieties and impostures. In this sense we meet with the Alcoran of the Cordeliers, which has made a great noise; wherein St Francis is extravagantly magnified, and put on a level with Jesus Christ. The Alcoran of the Cordeliers is properly an extract of a very scarce book, entitled, *The Conformity of the Life of the seraphic father St Francis with the Life of Christ*, published in 1510, 4to; since, at Bologna, in folio. Erasmus Albertus, being by the elector of Brandenburg appointed to visit a monastery of Franciscans,

Alcoran
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Alcuinus.

Franciscans, found this book; and being struck with the extreme folly and absurdity of it, collected a number of curiosities out of it, and published them under the title of the *Alcoran* of the Franciscans, with a preface by Martin Luther.

ALCORANISTS, among Mahometans, those who adhere strictly to the letter or text of the *Alcoran*, from an opinion of its ultimate sufficiency and perfection. The Persians are generally *Alcoranists*, as admitting the *Alcoran* alone for their rule of faith. The Turks, Tartars, Arabs, &c. besides the *Alcoran*, admit a multitude of traditions. The *Alcoranists*, among Mahometans, amount to much the same with the Textuaries among the Jews. The *Alcoranists* can find nothing excellent out of the *Alcoran*: are enemies of philosophers, metaphysicians, and scholastic writers. With them the *Alcoran* is every thing.

ALCOVE, in *Architecture*, a recess, or part of a chamber separated by an estrade, or partition of columns, and other corresponding ornaments, in which is placed a bed of state, and sometimes seats to entertain company. These alcoves are frequent in Spain; and the bed is raised two or three ascents, with a rail at the foot.

ALCUINUS, **FLACCUS**, an ecclesiastic of the eighth century. He was born, it is supposed, in Yorkshire. He was educated, however, at York, under the direction of Archbishop Egbert, as we learn from his own letters, in which he frequently calls that great prelate his beloved master, and the clergy of York the companions of his youthful studies. As he survived Venerable Bede about 70 years, it is hardly possible that he could have received any part of his education under him, as some writers of literary history have affirmed; and it is worthy of observation, that he never calls that great man his master, though he speaks of him with the highest veneration. It is not well known to what preferments he had attained in the church before he left England, though some say he was abbot of Canterbury. The occasion of his leaving his native country, was his being sent on an embassy by Offa king of Mercia to the emperor Charlemagne; who contracted so great an esteem and friendship for him, that he earnestly solicited, and at length prevailed upon him, to settle in his court, and become his preceptor in the sciences. Alcuinus accordingly instructed that great prince in rhetoric, logic, mathematics, and divinity; which rendered him one of his greatest favourites. "He was treated with so much kindness and familiarity (says a contemporary writer) by the emperor, that the other courtiers called him, by way of eminence, the *emperor's delight*." Charlemagne employed his learned favourite to write several books against the heretical opinions of Felix bishop of Urgel, in Catalonia, and to defend the orthodox faith against that heresiarch, in the council of Francfort, A. D. 894; which he performed to the entire satisfaction of the emperor and council, and even to the conviction of Felix and his followers, who abandoned their errors. The emperor consulted chiefly with Alcuinus on all things relating to religion and learning; and, by his advice, did many great things for the advancement of both. An academy was established in the imperial palace, over which Alcuinus presided, and in which the princes and prime nobi-

lity were educated; and other academies were established in the chief towns of Italy and France, at his instigation, and under his inspection. "France (says one of our best writers of literary history) is indebted to Alcuinus for all the polite learning it boasted of in that and the following ages. The universities of Paris, Tours, Fulden, Soissons, and many others, owe to him their origin and increase; those of whom he was not the superior and founder, being at least enlightened by his doctrine and example, and enriched by the benefits he procured for them from Charlemagne." After Alcuinus had spent many years in the most intimate familiarity with the greatest prince of his age, he at length, with great difficulty, obtained leave to retire from court to his abbey of St Martin's at Tours. Here he kept up a constant correspondence by letters with Charlemagne; from which it appears, that both the emperor and his learned friend were animated with the most ardent love to learning and religion, and constantly employed in contriving and executing the noblest designs for their advancement. He composed many treatises on a great variety of subjects, in a style much superior in purity and elegance to that of the generality of writers in the age in which he flourished. Charlemagne often solicited him, with all the warmth of a most affectionate friend, to return to court, and favour him with his company and advice; but he still excused himself; and nothing could draw him from his retirement in his abbey of St Martin in Tours, where he died A. D. 804. His works were collected and published by Andrew du Chesne in one volume folio, Paris, 1617. They consist of, 1. Tracts upon Scripture. 2. Tracts upon doctrine, discipline, and morality. 3. Historical treatises, letters, and poems. Since that edition, there has been published an incredible number of tracts, poems, &c. ascribed to this author, most of which, in all probability, were not his.

ALCYON, the trivial name of a species of alcedo. See **ALCEDO**, **ORNITHOLOGY Index**.

ALCYONIUM, an obsolete name of a submarine plant. It is also used for a kind of coral, or astroites, frequently found fossil in England.

ALCYONIUM Stagnum, in *Ancient Geography*, a lake in the territory of Corinth, whose depth was unfathomable, and in vain attempted to be discovered by Nero. Through this lake Bacchus is said to have descended to hell, to bring back Semele; (Pausanias.)

ALCYONIUS, **PETER**, a learned Italian, who flourished in the 16th century. He was well versed in the Greek and Latin tongues, and wrote some pieces of eloquence which met with great approbation. He was corrector of the press a considerable time for Aldus Manutius, and is entitled to a share in the praises given to the editions of that learned printer. He published a treatise concerning banishment, which contained so many fine passages intermixed with others quite the reverse, that it was thought he had tacked to somewhat of his own, several fragments of a treatise of Cicero de Gloria; and that afterwards, in order to save himself from being detected in this theft, he burnt the manuscript of Cicero, the only one extant. Paulus Manutius, in his commentary upon these words of Cicero, *Librum tibi celeriter mittam de gloria*, "I will speedily send you my treatise on Glory;" has the following passage relating to this affair: "He means

Alcuinus
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Alcyonius.

Alcyonius (says he) his two books on Glory, which were handed down to the age of our fathers; for Bernard Justinian, in the index of his books, mentions *Cicero de Gloria*. **Alderman**. This treatise, however, when Bernard had left his whole library to a nunnery, could not be found, though sought after with great care: nobody doubted but Peter Alcyonius, who, being physician to the nunnery, was entrusted with the library, had basely stolen it. And truly, in his treatise of Banishment, some things are found interspersed here and there, which seem not to savour of Alcyonius, but of some higher author." The two orations he made after the taking of Rome, wherein he represented very strongly the injustice of Charles V. and the barbarity of his soldiers, were excellent pieces. There is also an oration ascribed to him, on the knights who died at the siege of Rhodes.

ALDBOROUGH, a sea-port town of England, in Suffolk. It is pleasantly situated in a dale between a high hill to the westward, on which its large old-built church stands; the sea to the east, and its river running south-west. It is a large, long, ordinary town, made up of two or three streets of low houses, running parallel to each other. A quarter of a mile to the south lies Slaughden, where they have a commodious key, with warehouses for fish: more southerly still, they have conveniences for drying their north-sea fish. Their employment in the fishery is their chief business, which is considerable in the season for catching herrings and sprats; and it is the only place in England for curing red sprats. It is a town corporate, and sends two members to parliament. Towards the sea, it has some pieces of cannon planted for its defence. It is 88 miles north-east from London, and contained 1066 inhabitants in 1810. E. Long. 1. 32. N. Lat. 52. 50.

ALDBOROUGH, a market-town in the west riding of Yorkshire, seated on the river Ouse, 15 miles north-west of York, and 200 miles north of London. It sends two members to parliament. W. Long. 0. 20. N. Lat. 54. 15. It was anciently a Roman city, called *Isurium Brigantum*; and several coins and monuments of the Saxons and Romans have been discovered there.

ALDEBARAN, in *Astronomy*, a star of the first magnitude, called in English the *bull's eye*, as making the eye of the constellation Taurus. Its longitude is 6 deg. 32 min. 9 sec. of Gemini, and its latitude 5 deg. 29 min. 40 sec. south.

ALDER TREE. See *BETULA*, *BOTANY Index*.

ALDERHOLM, an island of Sweden, formed by the three arms of a river running through Gentle, a town of Nordland, in Sweden, 80 miles north from Stockholm. Here is a wharf, a repository for planks and deals, two packing houses, a large customhouse for taking toll of the ships, an arsenal for cannon, and a granary.

ALDERMAN, in the British policy, a magistrate subordinate to the lord-mayor of a city or town-corporate. The number of these magistrates is not limited, but is more or less according to the magnitude of the place. In London there are 26; each having one of the wards of the city committed to his care. This office is for life; so that when one of them dies, or resigns, a wardmote is called, who return two persons, one of whom the lord-mayor and aldermen choose to supply the vacancy. All the aldermen are justices of the

peace, by a charter of 15 Geo. II. The aldermen of London, &c. are exempted from serving inferior offices; nor shall they be put upon assizes, or serve on juries, so long as they continue to be aldermen.

ALDERMAN, among our Saxon ancestors, was a degree of nobility answering to earl or count at present.

ALDERMAN was also used, in the time of King Edgar, for a judge or justice. Thus we meet with the titles of *aldermannus totius Angliæ*, *aldermannus regis*, *comitatus*, *civitatis*, *burgi*, *castelli*, *hundredi sive wapentachii*, *et novemdecimorum*. According to Spelman, the *aldermannus totius Angliæ* seems to have been the same officer who was afterwards styled *capitalis justiciarius Angliæ*, or chief-justice of England; the *aldermannus regis* seems to have been an occasional magistrate, answering to our justice of assize; and the *aldermannus comitatus*, a magistrate who held a middle rank between what was afterward called the *earl* and the *sheriff*; he sat at the trial of causes with the bishop: the latter proceeding according to ecclesiastical law, and the former declaring and expounding the common law of the land.

ALDERNEY, an island in the British channel, subject to the crown of Great Britain. It is about eight miles in compass, and is separated from Cape la Hogue, in Normandy, by a narrow strait, called the *Race of Alderney*, which is a very dangerous passage in stormy weather when the two currents meet; otherwise it is safe, and has depth of water for the largest ships. Through this strait the French fleet made their escape after their defeat at La Hogue, in 1692. It is a healthy island, has but one church, is fruitful both in corn and pasture, and is remarkable for a fine breed of cows. The inhabitants, for their greater safety, live together in a town of the same name. The number of houses is said to be 200, and the inhabitants 1300. It has but one harbour, called *Crabby*, which is at a good distance from the town; and is only fit for small vessels. To the west lie the range of rocks called the *Caskets*, so dangerous to mariners. W. Long. 2. 17. N. Lat. 49. 50.

ALDHELM, or **ADELM**, St, bishop of Shireburn in the time of the Saxon Heptarchy. He is said to have been the son of Kenred, brother to Ina, king of the West Saxons; but, in the opinion of William of Malmesbury, his father was no more than a distant relation to the king. Having received the first part of his education in the school which one Macdulf, a learned Scot, had set up in the place where Malmesbury now stands, he travelled into France and Italy for his improvement. At his return home, he studied some time under Adrian abbot of St Augustine's in Canterbury, the most learned professor of the sciences who had ever been in England. In these different seminaries he acquired a very uncommon stock of knowledge; and became famous for his learning, not only in England, but in foreign countries; whence several learned men sent him their writings for his perusal and correction; particularly Prince Arcivil, a son of the king of Scotland, who wrote many pieces, which he sent to Aldhelm, "entreating him to give them the last polish, by rubbing off their Scots rust." He was the first Englishman who wrote in the Latin language both in prose and verse, and composed a book for the instruction of his countrymen in the prosody of that language. Be-

Alderman
Aldhelm

Aldhelm
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sides this, he wrote several other treatises on various subjects; some of which are lost, and others published by Martin Delrio and Canisius. Venerable Bede, who flourished in the end of this and the beginning of the next century, gives the following character of Aldhelm: "He was a man of universal erudition, having an elegant style, and being wonderfully well acquainted with books, both on philosophical and religious subjects." In fact, considering the cloud of ignorance by which he was surrounded, and the great difficulty of acquiring knowledge without proper instruction, Aldhelm was a very extraordinary man. From one of his letters to Hedda bishop of Winchester, concerning the nature of his studies whilst at Canterbury, he appears to have been indefatigably determined to acquire every species of learning in his power. For a copy of this curious epistle, see Henry's History, vol. ii. p. 320. King Alfred the Great declared, that Aldhelm was the best of all the Saxon poets; and that a favourite song, which was universally sung in his time, near 200 years after its author's death, was of his composition. When he was abbot of Malmesbury, having a fine voice, and great skill in music as well as poetry, and observing the backwardness of his barbarous countrymen to listen to grave instructions, he composed a number of little poems, which he sung to them after mass in the sweetest manner; by which they were gradually instructed and civilized. After this excellent person had governed the monastery of Malmesbury, of which he was the founder, about 30 years, he was made bishop of Shireburn, where he died A. D. 709.—He wrote, 1. *De octo vitiis principalibus*. This treatise is extant in *Bibliotheca Patrum* of Canisius. 2. *Ænigmatum versus mille*. This, with several other of his poems, was published by Martin Delrio at Mentz, 8vo, 1601. 3. A book addressed to a certain king of Northumberland, named Alfrid, on various subjects. 4. *De vita monachorum*. 5. *De laude sanctorum*. 6. *De arithmetica*. 7. *De astrologia*. 8. A book against the mistake of the Britons concerning the celebration of Easter; printed by Sonius, 1576. 9. *De laude virginitatis*; manuscript, in Bennet-college, Cambridge; published among Bede's *Opuscula*. Besides many sonnets, epistles, and homilies in the Saxon language.

ALDPORT, an ancient name for Manchester. See **MANCHESTER**.

ALDRED, abbot of Tavistock, was promoted to the bishopric of Worcester in the year 1046. He was so much in favour with King Edward the Confessor, and had so much power over his mind, that he obliged him to be reconciled with the worst of his enemies, particularly with Sweyn son of the Earl Goodwin, who had revolted against him, and came with an army to invade the kingdom. Aldred also restored the union and friendship between King Edward and Griffith king of Wales. He took afterwards a journey to Rome, and being returned into England, in the year 1054, he was sent ambassador to the emperor Henry II. He staid a whole year in Germany, and was very honourably entertained by Herman archbishop of Cologne, from whom he learned many things relating to ecclesiastical discipline, which on his return he established in his own diocese. In the year 1058 he went to Jerusalem, which no archbishop or bishop of England had ever done before him. Two years after he returned to

England; and Kinsius archbishop of York dying the 22d of December 1060, Aldred was elected in his stead on Christmas day following, and was permitted to retain the see of Worcester with the archbishopric of York, as some of his predecessors had done. Aldred went soon after to Rome, in order to receive the pall from the pope: He was attended by Toston earl of Northumberland, Giso bishop of Wells, and Walter bishop of Hereford. The pope received Toston very honourably, and made him sit by him in the synod which he held against the simonists. He granted to Giso and Walter their request, because they were tolerably well learned, and not accused of simony. But Aldred being by his answers found ignorant, and guilty of simony, the pope deprived him very severely of all his honours and dignities; so that he was obliged to return without the pall. On the way home he and his three fellow-travellers were attacked by some robbers, who took from them all that they had, though they did not offer to kill them. This obliged them to return to Rome; and the pope, either out of compassion, or by the threatenings of the earl of Northumberland, gave Aldred the pallium; but he was obliged to resign his bishopric of Worcester. However, as the archbishopric of York had been almost entirely ruined by the many invasions of foreigners, King Edward gave the new archbishop leave to keep 12 villages or manors which belonged to the bishopric of Worcester. Edward the Confessor dying in 1066, Aldred crowned Harold his successor. He also crowned William the Conqueror, after he had made him take the following oath, viz. that he would protect the holy churches of God and their leaders; that he would establish and observe righteous laws; that he would entirely prohibit and suppress all rapines and unjust judgments. He was so much in favour with the Conqueror, that this prince looked upon him as a father; and, though imperious in regard to every body else, he yet submitted to obey this archbishop: John Brompton gives us an instance of the king's submission, which at the same time shows the prelate's haughtiness.—It happened one day, as the archbishop was at York, that the deputy-governor or lord-lieutenant going out of the city with a great number of people, met the archbishop's servants, who came to town with several carts and horses loaded with provisions. The governor asked them to whom they belonged; and they having answered they were Aldred's servants, the governor ordered that all these provisions should be carried to the king's storehouse. The archbishop sent immediately some of his clergy to the governor, commanding him to deliver the provisions, and to make satisfaction to St Peter, and to him the saint's vicar, for the injury he had done them; adding, that if he refused to comply, the archbishop would make use of his apostolic authority against him, (intimating thereby that he would excommunicate him). The governor, offended at this proud message, used the persons whom the archbishop had sent him very ill, and returned an answer as haughty as the message was. Aldred thereupon went to London to make his complaint to the king; but in this very complaint he acted with his wonted insolence; for meeting the king in the church of St Peter at Westminster, he spoke to him in these words: "Hearken, O William: when thou wast but a foreigner, and

Aldred.

Aldred,
Aldrich.

God, to punish the sins of this nation, permitted thee to become master of it, after having shed a great deal of blood, I consecrated thee, and put the crown upon thy head with blessings; but now, because thou hast deserved it, I pronounce a curse over thee, instead of a blessing, since thou art become the persecutor of God's church, and of his ministers, and hast broken the promises and the oaths which thou madest to me before St Peter's altar." The king, terrified at this discourse, fell upon his knees, and humbly begged the prelate to tell him, by what crime he had deserved so severe a sentence. The noblemen, who were present were enraged against the archbishop, and loudly cried out he deserved death, or at least banishment, for having offered such an injury to his sovereign; and they pressed him with threatenings to raise the king from the ground. But the prelate, unmoved at all this, answered calmly, "Good men, let him lie there, for he is not at Aldred's but at St Peter's feet; he must feel St Peter's power, since he dared to injure his vicegerent." Having thus reproved the nobles by his episcopal authority, he vouchsafed to take the king by the hand, and to tell him the ground of his complaint. The king humbly excused himself, by saying he had been ignorant of the whole matter; and begged of the noblemen to entreat the prelate, that he might take off the curse he had pronounced, and to change it into a blessing. Aldred was at last prevailed upon to favour the king thus far; but not without the promise of several presents and favours, and only after the king had granted him to take such a revenge on the governor as he thought fit. Since that time (adds the historian) none of the noblemen ever dared to offer the least injury. It may be questioned, which was more surprising here, whether the archbishop's haughtiness, who dared to treat his sovereign after so unbecoming a manner; or the king's stupidity, who suffered such insolence and audaciousness from a priest.—The Danes having made an invasion in the north of England in the year 1068, under the conduct of Harold and Canute the sons of King Sweyn, Aldred was so much afflicted at it, that he died of grief the 11th of September in that same year, having besought God that he might not see the desolation of his church and country.

ALDRICH, ROBERT, bishop of Carlisle, was born at Burnham in Buckinghamshire about the year 1493, and educated at Eaton school; from whence, in 1507, he was elected scholar of King's college, Cambridge, where he took his degree in arts, and was afterwards proctor of the university. In 1525, he was appointed master of Eaton school, then became fellow of that college, and finally provost. In 1529, he went to Oxford, where, being first incorporated bachelor of divinity, in the following year he proceeded doctor in that faculty: in 1531, he was made archdeacon of Colchester; in 1534, canon of Windsor; and the same year, registry of the order of the Garter. He was consecrated bishop of Carlisle in the year 1537, and died at Horncastle in Lincolnshire in 1556. He wrote, 1. *Epistola ad Gul. Hormanum*, in Latin verse; printed in Horman's *Antibossican*, Lond. 1521, of which book Pitts erroneously makes Aldrich the author. 2. *Epigrammata varia*. 3. *Latin verses, and another epistle to Horman*, prefixed to the *Vulgaria puerorum* of that author, Lond. 1519, 4to. 4. *Answers to certain que-*

3.

ries concerning the abuses of the mass; also about receiving the sacrament.

Aldrich.

ALDRICH, Dr Henry, an eminent English divine and philosopher, born at London in 1647, was educated at Westminster school under the famous Dr Busby, and admitted of Christ-church college, Oxford. He had a great share in the controversy with the Papists in the reign of James II. and Bishop Burnet ranks him among those who examined all the points of Popery with a solidity of judgment, clearness of argument, depth of learning, and vivacity of writing, far beyond any who had before that time written in our language. He rendered himself so conspicuous, that at the Revolution, when Massey the Popish dean of Christ church fled, his deanery was conferred on him. In this station he behaved in an exemplary manner, and that fabric owes much of its beauty to his ingenuity: it was Aldrich who designed the beautiful square called *Peckwater Quadrangle*, which is esteemed an excellent piece of architecture. In imitation of his predecessor Dr Fell, he published, yearly, a piece of some ancient Greek author, as a present to the students of his house. He published *A System of Logic*, with some other pieces: and the revising Clarendon's History of the Rebellion was intrusted to him and Bishop Spratt; but it doth not appear that they made any additions, or considerable alterations in it, as has been asserted by Mr Oldmixon. Besides his preferments above mentioned, Dr Aldrich was also rector of Wem in Shropshire. He was chosen prolocutor of the convocation in 1702. This worthy person died at Christ-church on the 14th of December 1710. As to his character, he was a most universal scholar, and had a taste for all sorts of learning, especially architecture. Sir John Hawkins has favoured the public with several particulars relative to Dr Aldrich's skill in music; and on account of the Doctor's eminence in this respect, Sir John hath given his life, with his head prefixed. His abilities as a musician rank him, we are told, among the greatest masters of the science. He composed many services for the church, which are well known; as are also his anthems, nearly to the number of 20. He adapted, with great skill and judgment, English words to many of the notes of Palestrina, Carissimi, Victoria, and other Italian composers for the church, some of which are frequently sung in our cathedrals as anthems. By the happy talent which Dr Aldrich possessed, of naturalizing the compositions of the old Italian masters, and accommodating them to an English ear, he increased the stores of our own church. Though the Doctor chiefly applied himself to the cultivation of sacred music, yet being a man of humour, he could divert himself by producing pieces of a lighter kind. There are two catches of his; the one, "Hark the bonny Christ-church Bells;" the other entitled, "A Smoking Catch," to be sung by four men smoking their pipes, which is not more difficult to sing than diverting to hear. His love of smoking was, it seems, so excessive, as to be an entertaining topic of discourse in the university. Such was Dr Aldrich's regard for the advancement of music, and the honour of its professors, that he had formed a design of writing a history of the science; and the materials from which he proposed to compile it are yet extant in the library of his own college. It appears from these materials, that he had

marked.

Aldrich || Aldrovandus. marked down every thing which he had met with concerning music and musicians ; but that he had brought no part of them into any kind of form.

Dr Aldrich is of some note as a Latin poet. In the *Musæ Anglicanæ*, we find two elegant copies of verses by him ; one on the accession of King William III. and the other on the death of the duke of Gloucester. Sir John Hawkins has preserved a humorous translation by him of the well-known English ballad,

“ A soldier and a sailor,
“ A tinker and a tailor,” &c.

The following epigram, entitled “ *Causæ Bibendi*,” is likewise ascribed to Dr Aldrich :

“ *Si bene quid memini, Causæ sunt quinque bibendi,
“ Hospitis Adventus ; præsens Sitis, atque futura ;
“ Aut Vini Bonitas ; aut quæ libet altera Causa.*”

The epigram has been thus translated :

“ If on my theme I rightly think,
“ There are five reasons why men drink :
“ Good wine, a friend, because I'm dry,
“ Or lest I should be by and bye,
“ Or any other reason why.”

The translation is not equal to the original. It is evident, from the verses cited and referred to, that Dr Aldrich was of a very cheerful and pleasant turn of mind. Indeed, he is always spoken of as having been a man of wit ; and as one who, to his great talents and virtues joined those amiable qualities which rendered him the object of general affection, as well as of general esteem and respect. Having never been married, he appropriated his income to works of hospitality and beneficence, and encouraging learning to the utmost of his power, of which he was a most munificent patron, as well as one of the greatest men in England, if considered as a Christian or a gentlemen. He had always the interest of his college at heart, whereof he was an excellent governor. His modesty and humility prevented him from prefixing his name to the learned tracts which he published during his life. At his death he wished to be buried in the cathedral without any memorial ; which his thrifty nephew complied with, depositing him on the south side of Bishop Fell's grave, December 22. eight days after his decease ; which happened in the 63d or 64th year of his age.

ALDROVANDA. See BOTANY Index.

ALDROVANDUS, ULYSSES, professor of philosophy and physic at Bologna, the place of his nativity. He was a most curious inquirer into natural history, and travelled into the most distant countries on purpose to inform himself of their natural productions. Minerals, metals, plants, and animals, were the objects of his curious researches ; but he applied himself chiefly to birds, and was at a great expence to have figures of them drawn from the life. Aubert le Mire says, that he gave a certain painter, famous in that art, a yearly salary of 200. crowns, for 30 years and upwards ; and that he employed at his own expence Lorenzo Beunini and Cornelius Swintus, as well as the famous engraver Christopher Coriolanus. These expences ruined his fortune, and at length reduced him to the utmost necessity ; and it is said that he died blind in an hospital at Bologna, at a great age, in

1605. Mr Bayle observes, that antiquity does not furnish us with an instance of a design so extensive and so laborious as that of Aldrovandus, with regard to natural history ; that Pliny has treated of more kinds of subjects, but only touches lightly on them, saying but a little upon any thing, whereas Aldrovandus has collected all he could meet with. His compilation, or that compiled upon his plan, consists of 13 volumes in folio, several of which were printed after his death. He himself published his Ornithology, or History of Birds, in three folio volumes, in 1599 ; and his seven books of insects, which make another volume of the same size. The volume Of Serpents, three Of Quadrupeds, one Of Fishes, that Of exanguious Animals, the History of Monsters, with the Supplement to that of Animals, the treatise Of Metals, and the Dendrology or History of Trees, were published at several times after the death of Aldrovandus, by the care of different persons ; and Aldrovandus is the sole author only of the first six volumes of this work, the rest having been finished and compiled by others, upon the plan of Aldrovandus : a most extensive plan, wherein he not only relates what he has read in naturalists, but remarks also what historians have written, legislators ordained, and poets feigned : he explains also the different uses which may be made of the things he treats of, in common life, in medicine, architecture, and other arts ; in short, he speaks of morality, proverbs, devices, riddles, hieroglyphics, and many other things which relate to his subject.

ALDÜABIS, in *Ancient Geography*, a river of Celtic Gaul, which rising from Mount Jura, separating the Sequani from the Helvetii, and running through the county of Burgundy, or the Franche Comté, environs almost on every side the city of Besançon ; and running by Dole, falls into the Saone near Chalons. By Cæsar, it is called *Alduasdubis* ; in Ptolemy, *Dubis* : now *le Doux*.

ALE, a fermented liquor obtained from an infusion of malt, and differing from beer chiefly in having a less proportion of hops. (See BREWING). This liquor, the natural substitute of wine in such countries as could not produce the grape, was originally made in Egypt, the first planted kingdom, on the dispersion from the east, that was supposed unable to produce grapes. And, as the Noachian colonies pierced further into the west, they found, or thought they found, the same defect, and supplied it in the same manner. Thus the natives of Spain, the inhabitants of France, and the aborigines of Britain, all used an infusion of barley for their ordinary liquor ; and it was called by the various names of *Glælia* and *Cerid* in the first country, *Cerevisia* in the second, and *Curmi* in the last ; all literally importing only the *strong water*.

“ All the several nations (says Pliny) who inhabit the west of Europe, have a liquor with which they intoxicate themselves made of corn and water. The manner of making this liquor is sometimes different in Gaul, Spain, and other countries, and is called by many various names ; but its nature and properties are everywhere the same. The people of Spain, in particular, brew the liquor so well, that it will keep good a long time. So exquisite is the cunning of mankind ; in gratifying their vicious appetites, that they have thus invented a method to make water itself intoxicate.”

Aldrovandus || Ale.

Ale. cate." The method in which the ancient Britons, and other Celtic nations, made their ale, is thus described by Isidorus and Orosius. "The grain is steeped in water and made to germinate, by which its spirits are excited and set at liberty; it is then dried and grinded; after which it is infused in a certain quantity of water; which, being fermented, becomes a pleasant, warming, strengthening, and intoxicating liquor. This ale was most commonly made of barley, but sometimes of wheat, oats, and millet.

Anciently the Welch and Scots had also two kinds of ale, called *common ale* and *spiced ale*; and their value was thus ascertained by law: If a farmer hath no mead, he shall pay two casks of spiced ale, or four casks of common ale, for one cask of mead." By this law, a cask of spiced ale, nine palms in height and 18 palms in diameter, was valued at a sum of money equal in efficacy to 7l. 10s. of our present money; and a cask of common ale, of the same dimensions, at a sum equal to 3l. 15s. This is a sufficient proof, that even common ale in this period was an article of luxury among the Welch, which could only be obtained by the great and opulent. Wine seems to have been quite unknown, even to the kings of Wales, in this period, as it is not so much as once mentioned in their laws; though Giraldus Cambrensis, who flourished about a century after the Conquest, acquaints us, that there was a vineyard in his time at Maenarper, near Pembroke, in South Wales.

Ale was the favourite liquor of the Anglo-Saxons and Danes, as it had been of their ancestors the ancient Germans. Before their conversion to Christianity, they believed that drinking large and frequent draughts of ale was one of the chief felicities which those heroes enjoyed who were admitted into the hall of Odin.

There are various sorts of ale known in Britain, particularly *pale* and *brown*: the former is brewed from malt slightly dried; and is esteemed more viscid than the latter, which is made from malt more highly dried or roasted.

Pale ale brewed with hard waters, as those of springs and wells, is judged the most wholesome, in regard the mineral particles tend to prevent the cohesion of those drawn from the grain, and enable them to pass the proper secretions the better; softer waters, as those of rivers, and rain, seem better suited to draw out the substance of high dried malts, which retain many igneous particles, best absorbed in a smooth vehicle.

In Staffordshire, they have a secret of fining ale in a very short time. Plot conjectures it to be done by adding alum, or vinegar, in the working.

Ale is prepared various ways, and of various ingredients, as of wheat, rye, millet, oats, barley, the berries of the quickbean, &c.

Some have found that the juice which bleeds from the birch or sycamore is of great use on this occasion, applied instead of water. It makes one bushel of malt go as far as four in the common way.

Some have a method of preparing ale, so that it will keep, carried to the East or West Indies. The secret is, by mashing twice with fresh malt; boiling twice; and, after shipping it, putting to every five gallons two new-laid eggs whole, to remain therein. It is said, that in a fortnight's time the shell shall be dissolved,

and the eggs become like wind-eggs; and that afterwards the white would disappear, and the yolk remain untouched.

The consumption of ale in these kingdoms is incredible. It was computed twenty years ago at the value of four millions yearly, including Great Britain and Ireland.

The duties on ale and beer make a principal branch of the revenue in Britain. They were first imposed by the 12th of Car. II. and have been continued by several subsequent acts of parliament to first Geo. III. which lays an additional duty of 3d. per barrel. In the whole, the brewer of ale and beer for sale shall pay 8s. for every barrel of either above 6s. a barrel; and for every barrel of 6s. or under, the sum of 1s. 4d.

Medicated ALES, those wherein medicinal herbs have been infused, or added during the fermentation.

Gill ALE, is that in which the dried leaves of gill or ground-ivy have been infused. It is esteemed abster-sive and vulnerary, and consequently good in disorders of the breast and obstructions of the viscera.

ALE-Conner, an officer in London, who inspects the measures used in public houses. There are four ale-conners, who are all chosen by the liverymen in common hall on Midsummer day.

ALEHOUSES must be licensed by justices of the peace, who take recognizances of the persons licensed, and of their sureties, viz. 10l. each, that they will not suffer unlawful gaming, nor other disorderly practices in their houses. Every person, excepting those who sell ale in fairs, neglecting to procure a license, is liable to a penalty of 40s. for the first offence, 4l. for the second, and 6l. for the third, with all costs. The license granted on the first of September, or within twenty days after, at a general meeting of the justices for the division to which he belongs, upon his producing a certificate to his character, unless, by living in a city or town-corporate, this last circumstance is dispensed with, and continues in force for one year only. Alehouse keepers, selling ale in short measure, are liable to a penalty not exceeding 40s. and not less than 10s. and likewise to a fine of 10s. for permitting tippling, &c.

By 29th Geo. II. c. 12. persons keeping alehouses in Scotland shall be licensed as in England, and the justices there shall meet annually to license alehouses; on each of which licenses a fee of 1s. is payable to the clerk of the peace. Magistrates of royal boroughs shall meet yearly for the like purpose; but where there shall not be a sufficient number of magistrates to act in any royal borough, justices may grant licenses, to be in force for one year only. *Ibid.*

Persons in Scotland convicted of keeping unlicensed alehouses shall forfeit for the first offence 5s. for the second 10s. for the third 20s. and to be disqualified; and for every subsequent offence 40s. to be levied by distress and sale, one moiety to the informer, the other to the poor of the parish. Conviction to be intimated to the offender, and certified to the clerk of the peace, and recorded: but persons aggrieved may appeal to the quarter-sessions. *Ibid.*

Licenses for houses on the military roads in Scotland shall be issued on payment of 1s. only to the clerk of the peace: making out licenses before the same be stamped, is a penalty of 10l. and making them contrary

Ale ||
Alectoro-
mantia.

trary to the intention of this act, 5l. and the same shall be vacated, unless the duty and fine be paid, and the receipt produced, and license stamped. *Ibid.*

ALE-Silver, a tax paid annually to the lord-mayor of London by all who sell ale within the city.

ALEA, in Roman antiquity, denotes in general all manner of games of chance; but in a more restricted sense, was used for a particular game played with dice and tables, not unlike our backgammon.

ALEANDER, JEROME, cardinal and archbishop of Brindisi, was born in 1480; and distinguished himself at the beginning of the reformation, by the opposition he made to Luther: for being sent into Germany as the pope's nuncio in 1519, he acted, as occasion served, in the character of both ambassador and doctor; and declaimed three hours together against Luther's doctrine before the diet at Worms, but could not prevent that celebrated reformer from being heard in that diet. He published several works, and died at Rome in 1542.

ALEANDER, Jerome, nephew of the former, a learned man of the seventeenth century, born in the principality of Friuli, of the same family with the preceding. When he went to Rome, he was employed as secretary under Cardinal Octavius Bandini, and discharged this office with great honour for almost twenty years. He afterwards, by the persuasion of Urban VIII. who had a great esteem for him, became secretary to Cardinal Barberini, whom he accompanied to Rome when he went there in the character of legate à latere, and in whose service he died in 1631. He was one of the first members of the academy of Humorists, wrote a learned treatise in Italian on the device of the society, and displayed his genius on many different subjects. Barberini gave him a magnificent funeral at the academy of Humorists; the academists carried his corpse to the grave; and Gaspar Simeonibus, one of the members, made his funeral oration.

ALECTO, one of the FURIES, daughter of Acheron and Night, or, as others would have it, of Pluto and Proserpine.

ALECTORIA, a stone said to be formed in the gall-bladder of old cocks, to which the ancients ascribed many fabulous virtues. This is otherwise called *Alectorius lapis*, sometimes *Alectorolithos*, in English the *cock-stone*. The more modern naturalists hold the *alectorius lapis* to be originally swallowed down, not generated in, the stomach and gizzard of cocks and capons. It is known that many of the fowl kind make a practice of swallowing pebbles, as it is supposed to be of service in the business of trituration and digestion.

ALECTOROMANTIA, in *Antiquity*, a species of divination performed by means of a cock. This is otherwise called *Alectryomancy*; of which there appear to have been different species. But that most spoken of by authors was in the following manner: A circle was described on the ground, and divided into twenty-four equal portions; in each of these species was written one of the letters of the alphabet, and on each of the letters was laid a grain of wheat; after which, a cock being turned loose in the circle, particular notice was taken of the grains picked up by the cock, because the letters under them, being formed into a word, made the answer desired. It was thus, according to Zonaras, that Libanius and Jamblicus sought who

should succeed the emperor Valens; and the cock eating the grains answering to the spaces ΘΕΟΔ, several whose names began with those letters, as Theodotus, Theodistes, Theodulus, &c. were put to death; which did not hinder, but promote Theodosius, to the succession. But the story, however current, is but ill supported: It has been called in question by some, and refuted by others, from the silence of Marcellinus, Socrates, and other historians of that time.

ALEE, in the sea-language, a term only used when the wind, crossing or flanking the line of a ship's course, presses upon the masts and sails so as to make her incline to one side, which is called the lee-side: hence, when the helm is moved over to this side, it is said to be *alee*, or *hard-a-lee*.

ALEGAMBE, PHILIP, a celebrated Jesuit, born at Brussels in 1592, distinguished himself by publishing a Bibliotheque of the writers of his order, and died at Rome in 1652.

ALEGRETTE, a small town of Portugal, in Alentejo, on the confines of Port Alegre, on the river Caja, which falls into the Guadiana, a little below Badajoz, near the frontiers of Spanish Estremadura. It is a very pretty town, and finely situated; seven miles south-east of Port Alegre, and thirty north of Elvas. W. Long. 5. 20. N. Lat. 39. 6.

ALEIUS CAMPUS, in *Ancient Geography*, a plain in Cilicia, on this side the river Pyramus, near the mountain Chimera, famous for Bellerophon's wandering and perishing there, after being thrown off Pegasus; which is the reason of the appellation.

ALEMANIA, or **ALLEMANIA**, in *Ancient Geography*, a name of Germany, but not known before the time of the Antonines, and then used only for a part. After the Marcomanni and their allies had removed from the Rhine, a rabble, or collection of people from all parts of Gaul, as the term *Alemanni* denotes, prompted either by levity or poverty, occupied the lands, called *Decumates* by Tacitus, because they held them on a tithe; now supposed to be the duchy of *Wurtemberg*. Such appear to have been the small beginnings of Alemmania, which was in after-times greatly enlarged: but still it was considered as a distinct part; for Caracalla, who conquered the Alemanni, assumed the surname both of *Alemannicus* and *Germanicus*.

ALEMBDAR, an officer in the court of the Grand Signior, who bears the green standard of Mahomet when the sultan appears in public on any solemn occasion.

ALEMBERT, JOHN LE ROND D', an eminent French philosopher, was born at Paris in 1717. He derived the name of John le Rond from that of the church near which, after his birth, he was exposed as a founding. His father, informed of this circumstance, listened to the voice of nature and duty, took measures for the proper education of his child, and for his future subsistence in a state of ease and independence.

He received his first education in the College of the Four Nations, among the Jansenists, where he gave early marks of capacity and genius. In the first year of his philosophical studies, he composed a Commentary on the Epistle of St Paul to the Romans. The Jansenists considered this production as an omen that portended to the party of Port-Royal a restoration to

some

Alee ||
Alembert.

Alembert. some part of their ancient splendour, and hoped to find one day in M. d'Alembert a second Pascal. To render this resemblance more complete, they engaged their rising pupil in the study of the mathematics: but they soon perceived that his growing attachment to this science was likely to disappoint the hopes they had formed with respect to his future destination: they therefore endeavoured to divert him from this line; but their endeavours were fruitless.

At his leaving college, he found himself alone and unconnected with the world: and sought an asylum in the house of his nurse. He comforted himself with the hope, that his fortune, though not ample, would better the condition and subsistence of that family, which was the only one that he could consider as his own: Here, therefore, he took up his residence, resolving to apply himself entirely to the study of geometry: And here he lived, during the space of forty years, with the greatest simplicity, discovering the augmentation of his means only by increasing displays of his beneficence, concealing his growing reputation and celebrity from these honest people, and making their plain and uncouth manners the subject of good-natured pleasantry, and philosophical observation. His good nurse perceived his ardent activity; heard him mentioned as the writer of many books; but never took it into her head that he was a great man, and rather beheld him with a kind of compassion. "You will never," said she to him one day, "be any thing but a philosopher—and what is a philosopher?—a fool, who toils and plagues himself during his life, that people may talk of him when HE IS NO MORE."

As M. d'Alembert's fortune did not far exceed the demands of necessity, his friends advised him to think of a profession that might enable him to augment it. He accordingly turned his views to the law, and took his degrees in that line; but soon abandoned this plan, and applied to the study of medicine. Geometry, however, was always drawing him back to his former pursuits; and after many ineffectual efforts to resist its attractions, he renounced all views of a lucrative profession, and gave himself over entirely to mathematics and poverty.

In the year 1741 he was admitted member of the Academy of Sciences: for which distinguished literary promotion, at such an early age, he had prepared the way by correcting the errors of a celebrated work*, which was deemed classical in France in the line of geometry. He afterwards set himself to examine, with deep attention and assiduity, what must be the motion of a body which passes from one fluid into another more dense, in a direction not perpendicular to the surface separating the two fluids. Every one knows the phenomenon which happens in this case, and which amuses children under the denomination of *Ducks and Drakes*; but M. d'Alembert was the first who explained it in a satisfactory and philosophical manner.

Two years after his election to a place in the academy, he published his Treatise on Dynamics. The new principle developed in this treatise consisted in establishing equality, at each instant, between the changes that the motion of a body has undergone, and the forces or powers which have been employed to produce them; or, to express the thing otherwise, in separating into two parts the action of the moving powers, and

considering the *one* as producing alone the motion of the body in the second instant, and the *other* as employed to destroy that which it had in the first.

So early as the year 1744, M. d'Alembert had applied this principle to the theory of the equilibrium, and the motion of fluids; and all the problems before solved by geometricians became, in some measure, its corollaries. The discovery of this new principle was followed by that of a new calculus, the first trials of which were published in a *Discourse on the general Theory of the Winds*, to which the prize-medal was adjudged by the academy of Berlin in the year 1746, and which was a new and brilliant addition to the fame of M. d'Alembert.

He availed himself of the favourable circumstance of the king of Prussia having just terminated a glorious campaign by an honourable peace, and in allusion to this, dedicated his work to that prince in the three following Latin verses:

*Hæc ego de ventis, dum ventorum ocyor alis,
Palantes agit Austriacos Fredericus, et orbi,
Insignis lauro, ramum prætendit olivæ.*

Swifter than wind, while of the winds I write,
The foes of conquering Frederick speed their flight:
While laurel o'er the hero's temple bends,
To the tir'd world the olive branch he sends.

This flattering dedication procured the philosopher a polite letter from Frederick, and a place among his literary friends.

In the year 1747 d'Alembert applied his new calculus of "Partial Differences" to the problem of vibrating chords, whose solution, as well as the theory of the oscillation of the air and the propagation of sound, had been given but incompletely by the geometricians who preceded him, and these were his masters or his rivals.

In the year 1749 he furnished a method of applying his principles to the motion of any body of a given figure; and he solved the problem of the precession of the equinoxes, determined its *quantity*, and explained the phenomenon of the nutation of the terrestrial axis discovered by Dr Bradley.

In 1752, M. d'Alembert published a treatise on the *Resistance of Fluids*, to which he gave the modest title of an *Essay*; but which contains a multitude of original ideas and new observations. About the same time he published, in the Memoirs of the Academy of Berlin, *Researches concerning the Integral Calculus*, which is greatly indebted to him for the rapid progress it has made in the present century.

While the studies of M. d'Alembert were confined to geometry, he was little known or celebrated in his native country. His connexions were limited to a small society of select friends: he had never seen any man in high office except Messrs d'Argenson. Satisfied with an income which furnished him with the necessities of life, he did not aspire after opulence or honours, nor had they been hitherto bestowed upon him, as it is easier to confer them on those who solicit them than to look out for men who deserve them. His cheerful conversation, his smart and lively sallies, a happy knack at telling a story, a singular mixture of malice of speech with goodness of heart, and of delicacy

* The *Analytic demonstration* of F. Beniau.

lombert. of wit with simplicity of manners, rendered him a pleasing and interesting companion, and his company consequently was much sought after in the fashionable circles. His reputation, at length, made its way to the throne, and rendered him the object of royal attention and beneficence. He received also a pension from government, which he owed to the friendship of Count d'Argenson.

The tranquillity of M. d'Alembert was abated when his fame grew more extensive, and when it was known beyond the circle of his friends, that a fine and enlightened taste for literature and philosophy accompanied his mathematical genius. Our author's eulogist ascribes to envy, detraction, and to other motives equally ungenerous, all the disapprobation, opposition, and censure that M. d'Alembert met with on account of the publication of the famous Encyclopedical Dictionary of Arts and Sciences, in conjunction with Diderot. None surely will refuse the well-deserved tribute of applause to the eminent displays of genius, judgment, and true literary taste, with which M. d'Alembert has enriched the great work now mentioned. Among others, the Preliminary Discourse he has affixed to it, concerning the rise, progress, connections, and affinities of all the branches of human knowledge, is perhaps one of the first productions of which the philosophy of the present age can boast, and will be regarded as a striking specimen of just arrangement and sound criticism, and also as a model of accurate thinking and elegant writing.

Some time after this, D'Alembert published his Philosophical, Historical, and Philological Miscellanies. These were followed by the Memoirs of Christina queen of Sweden; in which M. d'Alembert showed that he was acquainted with the natural rights of mankind, and was bold enough to assert them. His "Essay on the Intercourse of Men of Letters with Persons high in Rank and Office," wounded the former to the quick, as it exposed to the eyes of the public the ignominy of those servile chains, which they feared to shake off, or were proud to wear. A lady of the court hearing one day the author accused of having exaggerated the despotism of the great, and the submission they require, answered slyly, *If he had consulted me, I would have told him still more of the matter.*

M. d'Alembert gave very elegant specimens of his literary abilities in his translations of some select pieces of Tacitus. But these occupations did not divert him from his mathematical studies: for about the same time he enriched the Encyclopédie with a multitude of excellent articles in that line, and composed his "Researches on several important Points of the System of the World," in which he carried to a higher degree of perfection the solution of the problem of the perturbations of the planets, that had several years before been presented to the Academy.

In 1759 he published his "Elements of Philosophy:" a work extolled as remarkable for its precision and perspicuity; in which, however, are some tenets relative both to metaphysics and moral science, that are far from being admissible.

The resentment that was kindled (and the disputes that followed it) by the article *Geneva*, inserted in the Encyclopédie, are well known. M. d'Alembert did not leave this field of controversy with flying colours. Voltaire was an auxiliary in the contest: but, as, in

point of candour and decency, he had no reputation to lose; and as he weakened the blow of his enemies, by throwing both them and the spectators into fits of laughter, the issue of the war gave him little uneasiness. It fell more heavily on D'Alembert; and exposed him, even at home, to much contradiction and opposition.

It was on this occasion that the late king of Prussia offered him an honourable asylum at his court, and the place of president of his academy; and was not offended at his refusal of these distinctions, but cultivated an intimate friendship with him during the rest of his life. He had refused, some time before this, a proposal made by the empress of Russia to intrust him with the education of the grand duke;—a proposal accompanied with all the flattering offers that could tempt a man ambitious of titles, or desirous of making an ample fortune: but the objects of his ambition were tranquillity and study.

In the year 1765, he published his "Dissertation on the Destruction of the Jesuits." This piece drew upon him a swarm of adversaries, who confirmed the merit and credit of his work by their manner of attacking it.

Beside the works already mentioned, he published nine volumes of memoirs and treatises under the title of *Opuscles*; in which he has solved a multitude of problems relative to astronomy, mathematics, and natural philosophy; of which our panegyrist gives a particular account, more especially of those which exhibit new subjects, or new methods of investigation.

He published also "Elements of Music;" and rendered, at length the system of Rameau intelligible; but he did not think the mathematical theory of the sonorous body sufficient to account for the rules of that art. He was always fond of music; which, on the one hand, is connected with the most subtle and learned researches of rational mechanics; while, on the other, its power over the senses and the soul exhibits to philosophers phenomena no less singular, and still more inexplicable.

In the year 1772, he was chosen secretary to the French academy. He formed, soon after this preferment, the design of writing the lives of all the deceased academicians from 1700 to 1772; and in the space of three years he executed this design, by composing 70 eulogies.

M. d'Alembert died on the 29th of October 1783. There were many amiable lines of candour, modesty, disinterestedness, and beneficence, in his moral character: which are described, with a diffusive detail, in his *éloge*, by M. Condorcet, *Hist. de l'Acad. Royale des Sciences*, 1783.

ALEMBIC, a chemical vessel usually made of glass or copper, formerly used for distillation. The bottom part, which contained the subject for distillation, is called, from its shape, the *cucurbit*; the upper part, which receives and condenses the steam, is called the *head*, the beak of which is fitted into the neck of a receiver. Retorts, and the common *worm still*, are now more generally employed.

ALEMBROTH, in the writings of the alchemists, a word used for a sort of fixed alkaline salt, which had the power of the famous alkahest, in dissolving bodies, opening the pores of most or all known substances, and

Alembert
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Alembroth.

Alenbroth
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Aleppo.

thence, as well as by destroying sulphurs, promoting the separation of metals from their ores.—It is also used for a compound of corrosive mercury and sal ammoniac.

ALENIO, JULIUS, a Jesuit, born at Brescia in the republic of Venice. He travelled into the eastern countries; and arrived at Macao in 1610, where he taught mathematics. From thence he went to the empire of China, where he continued to propagate the Christian religion for thirty-six years. He was the first who planted the faith in the province of Xansi, and he built several churches in the province of Fokien. He died in August 1649, leaving behind him several works in the Chinese language.

ALENTEJO, a province of Portugal, between the rivers Tajo and Guadiana: the soil is very fertile, and the inhabitants laborious and industrious. The principal town is Evora.

ALENZON, a town of France, the capital of the department of Orne, in Lower Normandy. It is surrounded with good walls, and flanked with towers. The castle was formerly a place of great consequence, and has held out long sieges. It has but one parish-church, which has a bold and noble front; and in 1815 had 13,234 inhabitants. It is seated on the river Sarte, in a vast open plain, which produces all sorts of corn and fruit. Near it there are quarries of stone fit for building, wherein are found a sort like Bristol stones. The trade of Alenzon is in linen, lace, stuffs, and leather. It is 20 miles north of Mons, 63 south-by-west of Ronen, and 88 south-west of Paris. E. Long. 0. 10. N. Lat. 48. 25.

ALEPPO, or **HALAB**, the capital of a pachalic, and of all Syria, and the ordinary residence of the pacha, is situated in the vast plain which extends from the Orontes to the Euphrates, and which towards the south terminates in the desert. It is built on eight hills or eminences, on the highest of which the castle is erected, and is supposed to be the ancient Beræa. This mount is of a conic form, and seems in a great measure to be raised with the earth thrown up out of a deep broad ditch which surrounds it. The suburbs to the north-north-east are next in height to this, and those to the west-south-west are much lower than the parts adjacent, and than any other part of the city. The houses are large and commodious, having terraces on their tops, and generally sky-lights in form of a dome to let the light into the rooms, which from their loftiness, the gilding on the window shutters, cupboard doors, &c. have at first entrance a very grand and agreeable effect. They are all so equal in height, that there are seldom any steps to ascend or descend in going from one house to another; while several large vaulted streets increase the facility of communication, by affording a passage to every part of the city free from the embarrassment of the open streets. They are carefully paved; have gutters and a foot-pavement on each side; and the middle of the street is laid with brick, the small end upwards, for the convenience of the horses. There is also a cleanliness observed here unknown to the other cities of Turkey, and which is not attended with the trouble of our scavengers, there being ass-drivers who go about the city and take up the rubbish and dust, which each inhabitant is obliged to sweep together; and though the heat of the climate

renders this labour more easy, the same heat obliges them to greater cleanliness in order to preserve the salubrity of the air. Aleppo.

The mosques in Aleppo are numerous, and some few of them magnificent. Before each of them is an area, with a fountain in the middle, designed for ablutions before prayers; and behind some of the larger there are little gardens. There are many large khans, or caravanseras, consisting of a capacious square, on all sides of which are a number of rooms, built on a ground-floor, used occasionally for chambers, warehouses, or stables. Above stairs there is a colonnade or gallery on every side, in which are the doors of a number of small rooms, wherein the merchants, as well strangers as natives, transact most of their business.

The bazars or market-places are long covered narrow streets, on each side of which are a great number of small shops, just sufficient to hold the tradesman and his goods, the buyer being obliged to stand without. Each separate branch of business has a particular bazar, which is locked up, as well as the streets, an hour and a half after sunset: but the locks are of wood, though the doors are cased with iron. The slaughter houses are in the suburbs, open to the fields. The tanners have a khan to work in near the river. To the southward in the suburbs they burn lime; and a little beyond that there is a village where they make ropes and catgut. On the opposite side of the river, to the westward, there is a glass-house, where they make a coarse white glass, in the winter only; for the greatest part of this manufacture is brought from a village 35 miles westward.

The situation of Aleppo, beside the advantage of a rich and fruitful soil, possesses also that of a stream of fresh water, which never becomes dry. This rivulet, which is about as large as that of the Gobelins at Paris, or the New river near London, rises in the mountains of Aentab, and terminates six leagues below Aleppo, in a morass full of wild boars and pelicans. Near Aleppo, its banks, instead of the naked rocks which line them in the upper part of its course, are covered with a fertile earth, and laid out in gardens, or rather orchards, which, in a hot country, and especially in Turkey, cannot but be delightful. The city is in itself one of the most agreeable in Syria, and is perhaps the cleanest and best built of any in Turkey. On whatever side it is approached, its numerous minarets and domes present an agreeable prospect to the eye, fatigued with the continued sameness of the brown and parched plains. In the centre is an artificial mountain surrounded by a dry ditch, on which is a ruinous fortress. From hence we have a fine prospect of the whole city, and to the north discover the snowy tops of the mountains of Bailan; and, on the west, those which separate the Orontes from the sea; while to the south and east, the eye can discern as far as the Euphrates. In the time of Omar, this castle stopped the progress of the Arabs for several months, and was at last taken by treachery, but at present would not be able to resist the feeblest assault. Its slight wall, low, and without a buttress, is in ruins; its little old towers are in no better condition; and it has not four cannon fit for service, not excepting a culverine nine feet long, taken from the Persians at the siege of Bassora. Three hundred and fifty janizaries, who should

Aleppo. should form the garrison, are busy in their shops, and the aga scarcely finds room in it to lodge his retinue. It is remarkable that this aga is named immediately by the Porte, which, ever suspicious, divides as much as possible the different offices. Within the walls of the castle is a well, which, by means of a subterraneous communication, derives its water from a spring a league and a quarter distant. In the environs of the city, we find a number of large square stones, on the top of which is a turban of stone, which are so many tombs. There are many rising grounds round it, which, in case of a siege, would greatly facilitate the approaches of the assailants. Such, among others, is that on which the house of the Derviches stands, and which commands the canal and the rivulet: Aleppo, therefore, cannot be esteemed a place of importance in war, though it be the key of Syria to the north; but, considered as a commercial city, it has a different appearance. It is the emporium of Armenia and Diarbekar; sends caravans to Bagdad and into Persia, and communicates between the Persian gulf and India by Bassora, with Egypt and Mecca by Damascus, and with Europe by Scanderoon (Alexandretta) and Latakia. Commerce is there principally carried on by barter. The chief commodities are raw or spun cottons, clumsy linen fabricated in the villages, silk stuffs manufactured in the city, copper, *bourres* (coarse cloths) like those of Rouen, goats hair brought from Natolia, the gall nuts of the Kourdestan, the merchandise of India, such as shawls and muslins, and pistachio nuts of the growth of the neighbourhood. The articles supplied by Europe are the Languedoc cloths, cochineal, indigo, sugar, and some other groceries. The coffee of America, though prohibited, is introduced, and serves to mix with that of Moka. The French have at Aleppo a consul and seven counting-houses; the English and the Venetians two, and the merchants of Leghorn and Holland one. The emperor appointed a consul there in 1784, in the person of a rich Jew merchant, who shaved his beard to assume the uniform and the sword. Russia has also sent one very lately. Aleppo is not exceeded in extent by any city in Turkey, except Constantinople and Cairo, and perhaps Smyrna. The number of inhabitants has been computed at 200,000; but in these calculations certainty is impossible. However, if we observe that this city is not larger than Nantes or Marseilles, and that the houses consist only of one story, we shall perhaps not think it probable they exceed 100,000. The people of this city, both Turks and Christians, are with reason esteemed the most civilized in all Turkey; and the European merchants no where enjoy so much liberty, or are treated with so much respect.

The air of Aleppo is very dry and piercing, but at the same time very salubrious for all who are not troubled with asthmatic complaints. The city, however, and the environs, are subject to a singular endemial disorder, which is called the ringworm or pimple of Aleppo: it is in fact a pimple which is at first inflammatory, and at length becomes an ulcer of the size of the nail. The usual duration of this ulcer is one year; it commonly fixes on the face, and leaves a scar which disfigures almost all the inhabitants. It is alleged that every stranger who resides there three months is attacked with it; experience has taught that the best

mode of treatment is to make use of no remedy. No reason is assigned for this malady: but M. Volney suspects it proceeds from the quality of the water, as it is likewise frequent in the neighbouring villages, in some parts of Diarbekar, and even in certain districts near Damascus, where the soil and the water have the same appearances. Of the Christian inhabitants the greater number are Greeks, next to them the Armenians, then the Syrians, and lastly the Maronites; each of whom has a church in the quarter called *Judida*; in which quarter, and the parts adjacent, most of them reside. The common language is the vulgar Arabic, but the Turks of condition use the Turkish. Most of the Armenians can speak the Armenian, some few Syrians understand Syriac, and many of the Jews Hebrew; but scarce one of the Greeks understands a word of Greek. The people in general are of a middle stature, and tolerably well proportioned; but they seem neither vigorous nor active. Both sexes are handsome when young: but the beard soon disfigures the men: and the women, as they come early to maturity, also fade very soon; females are generally married from 14 to 18 years of age, and many under 14. The people of rank here are polite and affable, making allowances for that superiority which the Mahometan religion instructs its votaries to assume over all who hold a different faith. The bread is generally of wheat flour made into thin cakes, but very ill prepared, and is generally eaten as soon as it comes out of the oven. The principal people have small loaves of finer flour, which are well fermented and baked. Besides these, there are a variety of biscuits, most of which are strewed on the top with some kind of seeds. The Europeans have very good bread, baked and prepared in the French manner. All the inhabitants of both sexes smoke tobacco to great excess; even the very servants have almost constantly a pipe in their mouth. Coaches or carriages are not used here; therefore persons of quality ride on horseback in the city, with a number of servants walking before them, according to their rank: ladies of the first distinction are even compelled to walk on foot in the city, or to any place at a moderate distance; in longer journeys they are carried by mules, in a kind of couch close covered up. There are a number of public bagnios in this city, which are used by people of all ranks, except those of the highest distinction, who commonly have baths and every other convenience in their own houses. Aleppo is 70 miles east of Scanderoon, on the sea-coast, and 175 north-by-east of Damascus. E. Long. 37. 4. N. Lat. 36. 12.

ALEPPO, *The Pachalic of*, one of the five governments into which Syria is divided. It comprehends the country extending from the Euphrates to the Mediterranean, between two lines, one drawn from Scanderoon to Beer, along the mountains: the other from Beles to the sea, by Mara and the bridge of Shoger. This space principally consists of two plains, that of Antioch to the west, and that of Aleppo to the east: the north and the sea-coast are occupied by considerably high mountains, known to the ancients by the name of Amanus and of Rhosus. In general, the soil of this government is fat and loamy. The lofty and vigorous plants which shoot up everywhere after the winter rains prove its fertility, but its actual fruitfulness is but little. The greatest part of the lands lie

Aleppo.

waste; scarcely can we trace any marks of cultivation in the environs of the towns and villages. Its principal produce consists in wheat, barley, and cotton, which are found especially in the flat country. In the mountains, they rather choose to cultivate the vine, mulberry, olive, and fig trees. The sides of the hills towards the sea-coast are appropriated to tobacco, and the territory of Aleppo to pistachios. The pasturage is not to be reckoned, because that is abandoned to the wandering hordes of the Turcomans and Curds.

In the greater part of the pachalics the pacha is, as his title imports, at once the viceroy and farmer-general of the country; but in that of Aleppo he does not possess the latter office. This the Porte has bestowed on a *mechassel* or collector, who is immediately accountable for what he receives. His lease is only for a year. The present rent of his farm is 800 purses (above 40,000*l.*); but to this must be added the price of the *babouches* (Turkish slippers), or a present of three or four thousand pounds, to purchase the favour of the vizier, and men in office. For these two sums the farmer receives all the duties of the government; which are first, The produce of import and export duties on merchandise coming from Europe, India, and Constantinople, and on that exported in exchange. Secondly, The taxes paid by the herds of cattle brought every year by the Turcomans and Curds from Armenia and Diarbekar, to be sold in Syria. Thirdly, The fifth of the salt-works of Djeboul. And, lastly, The miri, or land-tax. These united may produce about 60,000*l.*

The pacha, deprived of this lucrative branch of the administration, receives a fixed allowance of about 8300*l.* This revenue has always been inadequate to the expences; for besides the troops he is obliged to maintain, and the reparation of the highways and fortresses, the expences of which he is obliged to defray, he is under the necessity of making large presents to the ministers, in order to keep his place; but the Porte adds to the account the contributions he may levy on the Curds and Turcomans, and his extortions from the villages and individuals; nor do the pachas come short of this calculation. Abdi Pacha, who governed 13 or 14 years ago, carried off, at the end of 15 months, upwards of 160,000*l.* by laying under contribution every trade, even the very cleaners of tobacco-pipes; and very lately another of the same name has been obliged to fly for similar oppressions. The former was rewarded by the divan with the command of an army against the Russians; but if the latter has not enriched himself, he will be strangled as an extortioner. Such is the ordinary progress of affairs in Turkey!

In consequence of such wretched government, the greater part of the pachalics in the empire are impoverished and laid waste. This is the case in particular with that of Aleppo. In the ancient *defstars*, or registers of imposts, upwards of 3200 villages were reckoned; but at present the collector can scarcely find 400. Such of our merchants as have resided there 20 years, have themselves seen the greater part of the environs of Aleppo become depopulated. The traveller meets with nothing but houses in ruins, cisterns rendered useless, and fields abandoned. Those who cultivated them have fled into the towns, where the po-

pulation is absorbed, but where at least the individual conceals himself among the crowd from the rapacious hands of despotism.

ALERIA, ALALIA, or ALARIA, in *Ancient Geography*, a town of Corsica, situated near the middle of the east side of the island, on an eminence, near the mouth of the river Rotanus mentioned by Ptolemy; built by the Phocæans (Diodorus Siculus). Afterwards Sylla led a colony thither. It is now in ruins, and called *Aleria Distrutta*.

ALES, ALEXANDER, a celebrated divine of the confession of Augsburg, was born at Edinburgh the 23d of April 1500. He soon made a considerable progress in school divinity, and entered the lists very early against Luther, this being then the great controversy in fashion, and the grand field wherein all authors, young, and old, used to display their abilities. Soon after, he had a share in the dispute which Patrick Hamilton maintained against the ecclesiastics, in favour of the new faith he had imbibed at Marburg. He endeavoured to bring him back to the Catholic religion; but this he could not effect, and even began himself to doubt about his own religion, being much affected by the discourse of this gentleman, and still more by the constancy he showed at the stake, where David Beaton, archbishop of St Andrew's, caused him to be burnt. Beginning thus to waver, he was himself persecuted with so much violence, that he was obliged to retire into Germany, where he became at length a perfect convert to the Protestant religion. The change of religion which happened in England after the marriage of Henry VIII. with Anna Bullen, induced Ales to go to London in 1535. He was highly esteemed by Cranmer archbishop of Canterbury, Latimer, and Thomas Cromwell, who were at that time in high favour with the king. Upon the fall of these favourites, he was obliged to return to Germany; where the elector of Brandenburg appointed him professor of divinity at Frankfort upon the Oder, in 1540. But leaving this place upon some disgust, he returned to Leipsic, where he was chosen professor of divinity, and died in March 1565. He wrote a Commentary on St John, on the Epistles to Timothy, and on the Psalms, &c.

ALESA, ALESA, or HALESA, in *Ancient Geography*, a town of Sicily, on the Tuscan sea, built, according to Diodorus Siculus, by Archonides of Herbita, in the second year of the 94th Olympiad, or 403 years before Christ; situated on an eminence about a mile from the sea: now in ruins. It enjoyed immunity from taxes under the Romans (Diodorus, Cicero). The inhabitants were called *Halesini* (Cicero, Pliny); also *Alesini* and *Alesini*.

ALESHAM, a small neat town in Norfolk. It is 15 miles north of Norwich, and 121 north-east by north of London. E. Long. 0. 30. N. Lat. 52. 53. Population 1760, in 1810.

ALESIA, in *Ancient Geography*, called *Alexia* by Livy and others; a town of the Mandubii, a people of Celtic Gaul; situated, according to Cæsar, on a very high hill, whose foot was washed on two sides by two rivers. The town was of such antiquity, that Diodorus Siculus relates it was built by Hercules. It is supposed to be the city of *Alise*, in the duchy of Burgundy, not far from Dijon.

ALET, a town of France, in the department of the Aude,

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Aude, and district of Limoux, at the foot of the Pyrenees. It is remarkable for its baths, and for the grains of gold and silver found in the stream which runs from the Pyrenean mountains, at the foot of which it stands. It is seated on the river Aude, 15 miles south of Carcassone, and 37 north-west of Narbonne. E. Long. 2. 5. N. Lat. 42. 59.

ALETRIS. See BOTANY Index.

ALETUM, or ALETA, in *Ancient Geography*, a town of Celtic Gaul, now extinct. From its ruins arose St Malo in Brittany, at the distance of a mile. Its ruins are called *Guich Aleth* in the British.

ALEURITES. See BOTANY Index.

ALEUROMANCY, the same with what was otherwise called *alphitomantia*, and *crithomantia*, and means an ancient kind of divination performed by means of meal or flour.

ALEUTIAN or ALEUTSKY ISLANDS, a group or chain of islands on the north-east side of Kamschatka, and near the continent of America, which are subject to Russia. Part of these islands were discovered by Behring in the year 1741, and the rest at different periods since that time. Captain Cook visited these islands in 1778, and directed his researches and observations to a survey of them and of the adjacent coasts of Asia and America. On the Aleutian islands and the neighbouring coast, the Russians have formed numerous establishments for the support of the fur-trade, which is one of the most advantageous commercial concerns to the Russian empire. Captain Billings, who was set out by the late empress Catherine to make discoveries in the north-east sea, explored, in the summer 1790, the whole chain of these islands. They have since been visited by Krusenstern. They lie between the 51st and 56th degrees N. Lat. and the 164th and the 197th degrees of E. Long. See ALEUTIAN ISLANDS, SUPPLEMENT.

ALEXANDER THE GREAT, king of Macedonia. His father Philip laid the plan of that extensive empire, which his son afterwards completed. Philip, having made himself master of Greece, began to cast his eyes upon Persia, with a view to retaliate upon that haughty empire the injuries of former times. It was the popular topic of the day. But this prince was cut off in the midst of his enterprise. Such, however, was the influence of Alexander in the assembly of the Grecian states, that he was created general of their combined forces in the room of his father. Having made every needful preparation, at the head of a veteran army he invaded Asia. The lieutenants of Darius, who was then king of Persia, opposed him at the river Granicus, where Alexander obtained a complete victory, after which he pursued his march through Asia. At Issus, near Scanderoon, he was met by Darius in person, at the head of a prodigious army. Here he obtained a second victory; and took the camp of Darius, together with his family, whom he treated with the utmost humanity. Contrary to all the maxims of war, instead of pursuing Darius, he made an excursion into Egypt; and, as far as appears, through no better motives than those of vanity. Here he was acknowledged to be the son of Jupiter Ammon. In the mean time Darius recruited his strength, and got together an army superior to what he brought into the plain of Issus.

Alexander having finished his Egyptian expedition, traversed Asia, and passed the Euphrates. At Arbela, a town in Assyria, he met Darius. Here a decisive battle was fought, which put all Persia into the hands of Alexander. His ambition not being satisfied with the conquest of that vast country, he projected an expedition into India. Here he met with great opposition from Porus, a gallant prince, whom in the end he reduced. Beyond the Ganges lay a country still unsubdued. He notified it to his army, that he proposed to pass the river. But these veterans, harassed with their fatigues, and seeing no end of their labour, mutinied, and refused to march further. The disappointed chief was therefore obliged to return. At Babylon he proposed to receive ambassadors, appoint governors, and settle his vast monarchy; but his excesses put an end to his life in the midst of his designs, and in the flower of his age.

The character of this hero is so familiar to every body, that it is almost needless labour to draw it. All the world knows, says Mr Bayle, that it was equally composed of very great virtues and very great vices. He had no mediocrity in any thing but his stature: in his other properties, whether good or bad, he was all extremes. His ambition rose even to madness. His father was not at all mistaken in supposing the bounds of Macedon too small for his son: for how could Macedon bound the ambition of a man, who reckoned the whole world too small a dominion? He wept at hearing the philosopher Anaxarchus say, that there was an infinite number of worlds: his tears were owing to his despair of conquering them all, since he had not yet been able to conquer one. Livy, in a short digression, has attempted to inquire into the events which might have happened, if Alexander, after the conquest of Asia, had brought his arms into Italy. Doubtless things might have taken a very different turn with him; and all the grand projects, which succeeded so well against an effeminate Persian monarch, might easily have miscarried if he had had to do with rough hardy Roman armies. And yet the vast aims of this mighty conqueror, if seen under another point of view, may appear to have been confined in a very narrow compass; since, as we are told, the utmost wish of that great heart, for which the whole earth was not big enough, was, after all, to be praised by the Athenians: for it is related, that the difficulties which he encountered in order to pass the Hydaspes, forced him to cry out, "O Athenians, could you believe to what dangers I expose myself for the sake of being celebrated by you?" But Bayle affirms, that this was quite consistent with the vast unbounded extent of his ambition, as he wanted to make all future time his own, and be an object of admiration to the latest posterity; yet did not expect this from the conquest of worlds, but from books. He was perfectly in the right, says Bayle; "for if Greece had not furnished him with good writers, he would long ago have been as much forgotten as the kings who reigned in Macedon before Amphitryon."

Alexander has been praised upon the score of continency, yet his life could not surely be quite regular in that respect. Indeed, the fire of his early youth appeared so cold towards women, that his mother suspected.

Alexander.

Alexander. pected him to be impotent; and to satisfy herself in this point, did, with the consent of Philip, procure a very handsome courtesan to lie with him, whose carresses, however, were all to no purpose. His behaviour afterwards to the Persian captives shows him to have had a great command over himself in this particular. The wife of Darius was a finished beauty; her daughters likewise were all beauties; yet this young prince, who had them in his power, not only bestowed on them all the honours due to their high rank, but managed their reputation with the utmost delicacy. They were kept as in a cloister concealed from the world, and secured from the reach of every dishonourable (not only attack, but) imputation. He did not give the least handle to scandal, either by his visits, his looks, or his words: and for other Persian dames his prisoners, equally beautiful in face and shape, he contented himself with saying gaily, that they gave indeed much pain to his eyes. The amazon Thalestris could not obtain from him a compliance with her gallant request till after a delay of thirteen days. In the mean time, what are we to conclude from his causing his favourite mistress Pancaste to be drawn naked by Apelles, though it is true he gave her to the painter, who fell in love with her? What of that immoderate love of boys, which Athenæus relates of him? What of that prodigious number of wives and concubines which he kept?

His excesses with regard to wine were notorious, and beyond all imagination; and he committed, when drunk, a thousand extravagancies. It was owing to wine, that he killed Clitus, who saved his life, and burnt Persepolis, one of the most beautiful cities of the East: he did this last indeed at the instigation of the courtesan Thaïs; but this circumstance made it only the more heinous. It is generally believed, that he died by drinking immoderately: and even Plutarch, who affects to contradict it, owns that he did nothing but drink the whole day he was taken ill.

In short, to sum up the character of this prince, we cannot be of opinion, that his good qualities did in anywise compensate for his bad ones. Heroes make a noise: their actions glare, and strike the senses forcibly; while the infinite destruction and misery they occasion lie more in the shade, and out of sight. One good legislator is worth all the heroes that ever did or will exist. See MACEDON.

ALEXANDER AB ALEXANDRO, a Neapolitan lawyer, of great learning, who flourished toward the end of the 15th and beginning of the 16th century. He followed the profession of the law first at Naples, afterwards at Rome: but he devoted all the time he could spare to the study of polite literature; and at length he entirely left the bar, that he might lead a more easy and agreeable life with the Muses. The particulars of his life are to be gathered from his work entitled "*Dies Geniales*:" We are there informed, that he lodged at Rome, in a house that was haunted; and he relates many surprising particulars about the ghost. He says also, that when he was very young, he went to the lectures of Philadelphus, who explained at Rome the Tusculan questions of Cicero; he was there also when Nicholas Perot and Domitius Calderinus read their lectures upon Martial. The particular time when he died is not known; but he was buried in the monastery of the Olivets. Tiraquea wrote a learned com-

mentary upon his work, which was printed at Lyons in 1587, and reprinted at Leyden, in 1673, with the notes of Dennis Godfrey, Christopher Colerus, and Nicholas Mercerus.

ALEXANDER, *Neckham*, an eminent English writer in the 12th and 13th centuries, born at St Alban's in Hertfordshire. In 1215 he was made abbot of Exeter, and died in 1227. He wrote several works, which were never published; but they are to be found in manuscript in the libraries of England and other countries.

ALEXANDER, *Noel*, an indefatigable writer of the 17th century, born at Rouen in Normandy, 1639. After finishing his studies at Rouen, he entered into the order of Dominican friars, and was professed there in 1655. Soon after he went to Paris, to go through a course of philosophy and divinity in the great convent, where he distinguished himself so, that he was appointed to teach philosophy there, which he did for 12 years. M. Colbert showed him many marks of his esteem; and being determined to omit nothing to perfect the education of his son, afterwards archbishop of Rouen, he formed an assembly of the most learned persons, whose conferences upon ecclesiastical history might be of advantage to him. Father Alexander was invited to this assembly, where he exerted himself with so much genius and ability, that he gained the particular friendship of young Colbert, who showed him the utmost regard as long as he lived. These conferences gave rise to Alexander's design of writing an ecclesiastical history; for, being desired to reduce what was material in these conferences to writing, he did it with so much accuracy, that the learned men who composed this assembly, advised him to undertake a complete body of church history. This he executed with great assiduity, collecting and digesting the materials himself, and writing even the tables with his own hand. He at last completed his work in 1686. Towards latter part of his life, he was afflicted with the loss of his sight; a most inexpressible misfortune to one whose whole pleasure was in study, yet he bore it with great patience and resignation. He died merely of a decay of nature, 1724, in the 86th year of his age.

ALEXANDER SEVERUS, emperor of Rome, succeeded Heliogabalus about A. D. 222, when but 16 years of age. His mother's name was Mammæa, and by her advice he in a great measure regulated his conduct. He applied himself to the reformation of abuses, the state having been greatly disordered by the vicious conduct of his predecessor; he was a most strict lover of justice, an encourager of learning and learned men, and favourable to the Christians. He made a successful expedition against the Persians; but endeavouring to reform his troops, who had grown very licentious under the late bad government, they murdered him at the instigation of Maximinus, in the 29th year of his age, together with his mother, A. D. 235.

ALEXANDER VI. *Pope*, had four bastards when he was cardinal, for one of which he had so great affection, that he stuck at nothing to raise him. Designing to poison some cardinals, he was poisoned himself, A. D. 1503. See BORGIA.

ALEXANDER VII. *Pope*. See CHIGI.

ALEXANDER, bishop of Lincoln, in the reigns of Henry I. and Stephen, was a Norman by birth, and nephew

Alexander, phew of the famous Roger, bishop of Salisbury, who first made him archdeacon of Salisbury, and afterwards, by his interest with the king, raised him to the mitre. Alexander was consecrated at Canterbury, July 22. 1123. Having received his education under his uncle the bishop of Salisbury, and been accustomed to a splendid way of living, he affected show and state more than was suitable to his character, or consistent with his fortunes. This failing excepted, he was a man worthy of honour, and every way qualified for his station. The year after his consecration, his cathedral church at Lincoln having been accidentally burnt down, he rebuilt it, and secured it against the like accident for the future by a stone roof. This prelate increased the number of prebends in his church, and augmented its revenues with several manors and estates. In imitation of the barons, and some of the bishops, particularly his uncle the bishop of Salisbury, he built three castles; one at Banbury, another at Sleaford, and a third at Newark. He likewise founded two monasteries; one at Haverholm, for regular canons and nuns together, the other at Tame for white friars. He went twice to Rome in the years 1142 and 1144. The first time, he came back in quality of the pope's legate, for the calling a synod, in which he published several wholesome and necessary canons. In August 1147, he took a third journey to the pope, who was then in France; where he fell sick through the excessive heat of the weather, and returned with great difficulty to England, where he died, in the 24th year of his prelacy.

ALEXANDER, *William*, earl of Stirling, an eminent Scots statesman and poet in the reigns of James VI. and Charles I. who, after travelling with the duke of Argyle as his tutor or companion, wrote a poetical complaint of his unsuccessful love of some beauty, under the title of *Aurora*. He then removed to the court of James VI. where he applied to the more solid parts of poetry, forming himself upon the plan of the Greek and Roman tragedians. In 1607, he published some dramatic performances, entitled *The Monarchie Tragedies*, dedicated to King James; who was so well pleased with them, as to call him his philosophical poet. After this, he is said to have written *A Supplement* to complete the third part of Sir Philip Sidney's *Arcadia*; and in 1613, he produced a poem called *Doomsday, or the Great Day of Judgment*. He was made gentleman usher to Prince Charles, and master of the requests; was knighted; and obtained a grant of Nova Scotia, where he projected the settlement of a colony, but afterwards sold it to the French. In 1626, he was made secretary of state for Scotland; was created first viscount, and then earl, of Stirling; and died in 1640.

ALEXANDER I. *St*, whom St Irenæus reckons the fifth bishop of Rome, succeeded St Evaristus in the year 109, and died in the year 119. There is no account of his life; and the epistles which are attributed to him are supposititious.

ALEXANDER II. king of Scotland, succeeded his father William in 1213, at 16 years of age. He made an expedition into England, to oppose the tyranny of King John; who returned the visit, and was offered battle by Alexander, but refused it. He took the city of Carlisle from Henry III. which was afterwards

exchanged for Berwick. Alexander died in 1249, in the 51st year of his age, and 35th of his reign; and left for his successor, his son—

ALEXANDER III. who was crowned king of Scotland in 1249. The Cummings, a powerful family, took arms against him; and taking him prisoner, confined him at Stirling: but he was afterwards released by his subjects. He married the daughter of Henry III. king of England; and was at length killed by a fall from his horse, on the 10th of April 1290, after having reigned 42, or according to others 37, years.

ALEXANDERS, in *Botany*. See SMYRNIUM.

ALEXANDRETTA, by the Turks called *Scanderoon*; a town in Syria, at the extremity of the Mediterranean sea. It is the port of Aleppo, from which it is distant 28 or 30 leagues. It is now, properly speaking, nothing else but a village, without walls, in which the tombs are more numerous than the houses, and which entirely owes its existence to the road which it commands. This is the only road, in all Syria, where vessels anchor on a solid bottom, without their cables being liable to chafe: but in other respects it has many inconveniences. It is infested, during winter, by a peculiar wind, called by the French sailors *le Raguier*, which, rushing from the snowy summits of the mountains, frequently forces ships to drag their anchors several leagues: And when the snow begins to cover the mountains which surround the gulf, tempestuous winds arise which prevent vessels from entering for three or four months together. The road also to Aleppo by the plain is infested by Curd robbers, who conceal themselves in the neighbouring rocks, and frequently attack and plunder the strongest caravans. But the worst circumstance is the extreme unwholesomeness of the air, occasioned here by stagnant waters and mephitic exhalations. It may be affirmed that this every year carries off one-third of the crews of the vessels which remain here during the summer; nay, ships frequently lose all their men in two months. The season for this epidemic disorder is principally from May to the end of September: it is an intermitting fever of the most malignant kind; and is accompanied with obstructions of the liver, which terminate in dropsy. To this baneful epidemic, Alexandretta, from its situation, seems to be irremediably condemned: for the plain on which the town is built is so low and flat, that the rivulets, finding no declivity, can never reach the sea. When they are swelled by the winter rains, the sea, likewise swelled by tempests, hinders their discharging themselves into it: hence their waters, forced to spread themselves, form lakes in the plain. On the approach of the summer, the waters become corrupted by the heat, exhale vapours equally corrupt, and which cannot disperse, being confined by the mountains that encircle the gulf. The entrance of the bay besides lies to the west, which in those countries is the most unhealthy exposure when it corresponds with the sea. The labour necessary to remedy this would be immense, and after all insufficient: and, indeed, such an undertaking would be absolutely impossible under a government like that of the Turks. A few years ago, Mr Volney informs us, the merchants of Aleppo, disgusted with the numerous inconveniences of Alexandretta, wished to abandon that port and carry the trade to

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to Latakia. They proposed to the pacha of Tripoli to repair the harbour at their own expence, provided he would grant them an exemption from all duties for ten years. To induce him to comply with their request, the agent then employed talked much of the advantage which would *in time*, result to the whole country: "But what signifies it to me what may happen *in time*," replied the pacha? I was yesterday at Marach; to-morrow, perhaps, I shall be at Djedda: Why should I deprive myself of present advantages, which are certain, for future benefits I cannot hope to partake?" The European factors were obliged therefore to remain at Scanderoon. There are three of these factors, two for the French, and one for the English and Venetians. The only curiosity which they have to amuse strangers with consists in six or seven marble monuments, sent from England, on which you read: *Here lies such a one, carried off in the flower of his age, by the fatal effects of a contagious air.* The sight of these is the more distressing, as the languid air, yellow complexion, livid eyes, and dropsical bellies of those who show them, make it but too probable they cannot long escape the same fate. It is true, they have some resource in the village of Bailan, the pure air and excellent water of which surprisingly restore the sick. The aga, for some years past, has applied the duties of the customhouse of Alexandretta to his own use, and rendered himself almost independent of the pacha of Aleppo. The Turkish empire is full of rich rebels, who frequently die in peaceable possession of their usurpations.

ALEXANDRIA, in *Ancient Geography*, a mountain of Mysia, on the sea coast, forming a part of Mount Ida, where Paris gave judgment on the three goddesses.

ALEXANDRIA, now *Scandaria*, by Athenæus called *Ἐλευση*; a city of Lower Egypt, and for a long time its capital. This city was built by Alexander the Great, soon after the overthrow of Tyre, about 333 years before Christ. It is situated on the Mediterranean, twelve miles west of that mouth of the Nile anciently called *Canopicum*; and lies in E. Long. 30. 9. N. Lat. 31. 10.

Alexander is said to have been induced to build this city, on account of its being conveniently situated for a fine port; and so sudden was his resolution, that after he had directed where every public structure was to be placed, fixed the number of temples, and the deities to whom they should be dedicated, &c. there were no instruments at hand proper for marking out the walls, according to the custom of those times. Upon this, a workman advised the king to collect what meal was among the soldiers, and to sift it in lines upon the ground, whereby the circuit of the walls would be sufficiently marked out. This advice was followed; and the new method of marking out the walls was, by Aristander, the king's southsayer, interpreted as a presage of the city's abounding with all the necessaries of life. Nor was he deceived in his predictions; for Alexandria soon became the staple, not only for merchandise, but also for all the arts and sciences of the Greeks.

Alexandria was a league and a half long, by one-third in breadth, which made the circumference of its walls about four leagues. Lake Mareotis bathed

its walls on the south, and the Mediterranean on the north. It was intersected lengthwise by straight parallel streets. This direction left a free passage to the northern wind, which alone conveys coolness and salubrity into Egypt. A street of 2000 feet wide began at the gate of the sea, and terminated at the gate of Canopus. It was decorated with magnificent houses, temples, and public buildings. In this extensive range, the eye was never tired with admiring the marble, the porphyry and obelisks, which were destined at some future day to embellish Rome and Constantinople. This street, the handsomest in the universe, was intersected by another of the same breadth, which formed a square at their junction of half a league in circumference. From the middle of this great place, the two gates were to be seen at once, and vessels arriving under full sail from the north and from the south.

A mole of a mile in length stretched from the continent to the isle of Pharos, and divided the great harbour into two. That which is to the northward preserved its name. A dike drawn from the island to the rock whereon was built the Pharos, secured it from the westerly winds. The other was called *Eunostos*, or the Safe Return. The former is called at present the new, the latter the old harbour: a bridge that joins the mole to the city, served for a communication between them. It was raised on lofty pillars sunk into the sea, and left a free passage for ships. The palace, which advanced beyond the promontory of *Lochias*, extended as far as the dike, and occupied more than a quarter of the city. Each of the Ptolemies added to its magnificence. It contained within its enclosure, the museum, an asylum for learned men, groves, and buildings worthy of royal majesty, and a temple where the body of Alexander was deposited in a golden coffin. The infamous Seleucus Cibyofactes violated this monument, carried off the golden coffin, and put a glass one in its place. In the great harbour was the little island of Anti-Rhodes, where stood a theatre, and a royal place of residence. Within the harbour of *Eunostos* was a smaller one, called *Kibotos*, dug by the hand of man, which communicated with Lake Mareotis by a canal. Between this canal and the palace was the admirable temple of Serapis, and that of Neptune near the great place where the market was held. Alexandria extended likewise along the southern banks of the lake. Its eastern part presented to view the gymnasium, with its porticoes of more than 600 feet long, supported by several rows of marble pillars. Without the gate of Canopus was a spacious circus for the chariot races. Beyond that, the suburb of Nicopolis ran along the seashore, and seemed a second Alexandria. A superb amphitheatre was built there with a race-ground, for the celebration of the quinquennalia.

Such is the description left us of Alexandria by the ancients, and above all by Strabo.

The architect employed by Alexander in this undertaking was the celebrated Dinocrates, who had acquired so much reputation by rebuilding the temple of Diana at Ephesus. The city was first rendered populous by Ptolemy Soter, one of Alexander's captains, who, after the death of the Macedonian monarch, being appointed governor of Egypt, soon assumed the title of king, and took up his residence at Alexandria, about 304 years before Christ.

Alexandria. In the 30th year of Ptolemy Soter's reign, he took his son Ptolemy Philadelphus partner with him in the empire; and by this prince the city of Alexandria was much embellished. In the first year of his reign the famous watch-tower of Pharos was finished. It had been begun several years before by Ptolemy Soter; and, when finished, was looked upon as one of the wonders of the world. The same year, the island of Pharos itself, originally seven furlongs distant from the continent, was joined to it by a causeway. This was the work of Dexiphanes, who completed it at the same time that his son put the last hand to the tower. The tower was a large square structure of white marble; on the top of which fires were kept constantly burning, for the direction of sailors. The building cost 800 talents; which, if Attic, amounted to 165,000l.; if Alexandrian, to twice that sum.

The architect employed in this famous structure fell upon the following contrivance to usurp the whole glory to himself.—Being ordered to engrave upon it the following inscription:—"King PTOLEMY to the Gods the Saviours for the benefit of Sailors;" instead of the king's name he substituted his own, and then filling up the hollow of the marble with mortar, wrote upon it the above-mentioned inscription. In process of time, the mortar being worn off, the following inscription appeared: "SOSTRATUS the CNIDIAN, the son of DEXIPHANES, to the Gods the Saviours, for the benefit of Sailors."

This year also was remarkable for the bringing of the image of Serapis from Pontus to Alexandria. It was set up in one of the suburbs of the city called *Rhacotis*, where a temple was afterwards erected to his honour, suitable to the greatness of that stately metropolis, and called, from the god worshipped there, *Serapeum*. This structure, according to Ammianus Marcellinus, surpassed in beauty and magnificence all others in the world, except the capitol at Rome.—Within the verge of this temple was the famous Alexandrian library. It was founded by Ptolemy Soter, for the use of an academy he instituted in this city; and, by continual additions by his successors, became at last the finest library in the world, containing no fewer than 700,000 volumes. The method followed in collecting books for this library, was, to seize all those which were brought into Egypt by Greeks or other foreigners. The books were transcribed in the museum by persons appointed for that purpose; the copies were then delivered to the proprietors, and the originals laid up in the library. Ptolemy Euergetes, having borrowed from the Athenians the works of Sophocles, Euripides, and Æschylus, returned them only the copies, which he caused to be transcribed in as beautiful a manner as possible; presenting the Athenians at the same time with fifteen talents (upwards of 30,000l. sterling) for the exchange.

As the museum was at first in that quarter of the city called *Bruchion*, near the royal palace, the library was placed there likewise; but when it came to contain 400,000 volumes, another library, within the *Serapeum*, was erected by way of supplement to it, and on that account called the *daughter* of the former. In this second library 300,000 volumes, in process of time, were deposited; and the two together contained

the 700,000 volumes already mentioned. In the war *Alexandria.* carried on by Julius Cæsar against the inhabitants of this city, the library in the *Bruchion*, with the 400,000 volumes it contained, was reduced to ashes. The library in the *Serapeum*, however, still remained; and here Cleopatra deposited 200,000 volumes of the Pergamean library, which Mark Antony presented her with. These, and others added from time to time, rendered the new library at Alexandria more numerous and considerable than the former; and though it was often plundered during the revolutions and troubles of the Roman empire, yet it was again and again repaired, and filled with the same number of books.

For 293 years Alexandria was held in subjection by the Ptolemies. Here is a list of these princes, with the dates of their respective reigns.

Ptolemy the son of Lagus, surnamed *Soter*, reigned 39 years, and died in the year of the world 3720. Ptolemy Philadelphus reigned 39 years, and died in 3758. Ptolemy Euergetes reigned 25 years, and died in 3783. Ptolemy Philopater reigned 17 years, and died in 3800. Ptolemy Epiphanes reigned 24 years, and died in 3824. Ptolemy Philometor reigned 37 years, and died in 3861. Ptolemy, Euergetes or Physcon, reigned 53 years, part with his brother Philometor, and part alone. He died in 3888. Ptolemy Lathyrus reigned 36 years six months. He died in 3923. Cleopatra, the daughter of Lathyrus and wife of Alexander I. reigned six months. Alexander I. the nephew of Lathyrus, was established in 3924, and died in 3943. Alexander II. the son of Alexander I. was dispossessed by the Alexandrians in 3939. Ptolemy Nothus, or Auletes, the son of Lathyrus, reigned 13 years, and died in 3953. Ptolemy, surnamed *Dionysius* or *Bacchus*, reigned three years eight months, and died in 3957. Cleopatra reigned from 3957, and killed herself in 3974.

This city, as we have already observed, soon became extremely populous, and was embellished both by its own princes and the Romans; but, like most other noted cities of antiquity, hath been the seat of terrible massacres. About 141 years before Christ, it was almost totally depopulated by Ptolemy Physcon. That barbarous monster, without the least provocation, gave free liberty to his guards to plunder his metropolis and murder the inhabitants at their pleasure. The cruelties practised on this occasion cannot be expressed; and the few who escaped were so terrified that they fled into other countries. Upon this, Physcon, that he might not reign over empty houses, invited thither strangers from the neighbouring countries; by whom the city was re-peopled, and soon recovered its former splendour. On this occasion, many learned men having been obliged to fly, proved the means of reviving learning in Greece, Asia Minor, and the islands of the Archipelago, and other places, where it was almost totally lost.

The new inhabitants were not treated with much more kindness by Physcon than the old ones had been; for, on their complaining of his tyrannical behaviour, he resolved on a general massacre of the young men. Accordingly, when they were one day assembled in the gymnasium, or place of their public exercises, he ordered it to be set on fire; so that they all perished,

Alexandria. ed, either in the flames, or by the swords of his mercenaries, whom the tyrant had placed at all the avenues.

Though Julius Cæsar was obliged to carry on a war for some time against this city, it seems not to have suffered much damage, except the burning of the library already mentioned. Before Cæsar left Alexandria, in acknowledgment of the assistance he had received from the Jews, he confirmed all their privileges there, and even engraved his decree on a pillar of brass. This, however, did not prevent the massacre of 50,000 of them in this city about the year of Christ 67.

The city of Alexandria seems to have fallen into decay soon after this, and to have forfeited many of its ancient privileges, though for what offence is not known; but when Adrian visited Egypt, about the year 141, it was almost totally ruined. He repaired both the public and private buildings, not only restoring the inhabitants to their ancient privileges, but heaping new favours upon them; for which they returned him their solemn thanks, and conferred upon him what honours they could while he was present; but as soon as he was gone, they published the most virulent and bitter lampoons against him.

The fickle and satirical humour of the Alexandrians was highly disliked by Adrian, though he inflicted no punishment upon them for it; but when they lampooned Caracalla, he did not let them escape so easily. That tyrant, in the year 215, when he visited their city, having become the subject of their foolish satires, ordered a general massacre, by his numerous troops, who were dispersed all over the city. The inhuman orders being given, all were murdered, without distinction of age or sex; so that in one night's time the whole city floated in blood, and every house was filled with carcases. The monster who occasioned this had retired during the night to the temple of Serapis, to implore the protection of that deity; and, not yet satiated with slaughter, commanded the massacre to be continued all the next day; so that very few of the inhabitants remained. As if even this had not been sufficient, he stripped the city of all its ancient privileges; suppressed the academy; ordered all strangers who lived there to depart; and that the few who remained might not have the satisfaction of seeing one another, he cut off all communication of one street with another, by walls built for that purpose, and guarded by troops left there.

Notwithstanding this terrible disaster, Alexandria soon recovered its former splendour, as Caracalla was murdered a short time after. It was long esteemed the first city in the world, next to Rome; and we may judge of its magnificence, and the multitude of people contained in it, from the account of Diodorus Siculus, who relates, that in his time (44 years before Christ) Alexandria had on its rolls 300,000 freemen. Towards the middle of the sixth century, Amrou *Ebn al Aas*, Omar's general, took it by storm, after a siege of 14 months, and with the loss of 23,000 men. Heraclius, then emperor of Constantinople, did not send a single ship to its assistance. This prince affords an example very rare in history; he had displayed some vigour in the first year of his reign, and then suffered himself to be lulled into idleness and effeminacy. Awakened suddenly from his lethargy by the noise of

the conquests of Cosroes, that scourge of the east, he put himself at the head of his armies, distinguished himself as a great captain from his very first campaign, laid waste Persia for seven years, and returned to his capital covered with laurels: he then became a theologian on the throne, lost all his energy, and amused himself the rest of his life with disputing upon Monotheism, whilst the Arabs were robbing him of the finest provinces of the empire. Deaf to the cries of the unfortunate inhabitants of Alexandria, as he had been to those of the people of Jerusalem, who defended themselves for two years, he left them a sacrifice to the fortunate ascendant of the indefatigable Amrou. All their intrepid youth perished with their arms in their hands.

The victor, astonished at his conquest, wrote to the caliph, "I have taken the city of the west. It is of an immense extent. I cannot describe to you how many wonders it contains. There are 4000 palaces, 4000 baths, 12,000 dealers in fresh oil, 12,000 gardeners, 40,000 Jews who pay tribute, 400 theatres or places of amusement."

At this time, according to the Arabian historians, Alexandria consisted of three cities, viz. *Menna*, or the port, which included Pharos, and the neighbouring parts; *Alexandria*, properly so called, where the modern Scanderia now stands; and *Nekita*, probably the Necropolis of Josephus and Strabo.

At that time John, surnamed *the Grammarian*, a famous Peripatetic philosopher, being in the city, and in high favour with Amrou Ebn al Aas the Saracen general, begged of him the royal library. Amrou replied that it was not in his power to grant such a request; but that he would write to the caliph on that head; since, without knowing his pleasure, he dared not to dispose of a single book. He accordingly wrote to Omar, who was then caliph, acquainting him with the request of his friend: to which the ignorant tyrant replied, That if those books contained the same doctrine with the Koran, they could be of no use, since the Koran contained all necessary truths; but if they contained any thing contrary to that book, they ought not to be suffered; and therefore, whatever their contents were, he ordered them to be destroyed. Pursuant to this order, they were distributed among the public baths; where for the space of six months, they served to supply the fires of those places, of which there was an incredible number in Alexandria.

After the city was taken, Amrou thought proper to pursue the Greeks who had fled farther up the country; and therefore marched out of Alexandria, leaving but a very slender garrison in the place. The Greeks, who had before fled on board their ships, being apprised of this, returned on a sudden, surprised the town, and put all the Arabs they found therein to the sword: but Amrou, receiving advice of what had happened, suddenly returned, and drove them out of it with great slaughter: after which the Greeks were so intimidated, that he had nothing farther to fear from them.—A few years after, however, Amrou being deprived of his government by the caliph Othman, the Egyptians were so much displeased with his dismissal that they inclined to a revolt; and Constantine the Greek emperor, having received intelligence of their disaffection, began to meditate the reduction of Alexandria. For this purpose, he

andria. he sent one Manuel, an eunuch, and his general, with a powerful army, to retake that place; which, by the assistance of the Greeks in the city, who kept a secret correspondence with the imperial forces while at sea, and joined them as soon as they had made a descent, he effected, without any considerable effusion of Christian blood. The caliph, now perceiving his mistake, immediately restored Amrou to his former dignity. This step was very agreeable to the natives; who having had experience of the military skill and bravery of this renowned general, and apprehending that they should be called to an account by the Greeks for their former perfidious conduct, had petitioned Othman to send him again into Egypt.—Upon Amrou's arrival, therefore, at Alexandria, the Copts or natives, with the traitor Al-Mokawkas (who had formerly betrayed to Amrou the fortress of Mesr) at their head, not only joined him, but supplied him with all kinds of provisions, exciting him to attack the Greeks without delay. This he did; and, after a most obstinate dispute which lasted several days, drove them into the town, where, for some time, they defended themselves with great bravery, and repelled the utmost efforts of the besiegers. This so exasperated Amrou, that he swore, "If God enabled him to conquer the Greeks, he would throw down the walls of the city, and make it as easy of access as the house of a prostitute. Nor did he fail to execute his threat; for having taken the town by storm, he quite dismantled it, entirely demolishing the walls and fortifications. The lives of the citizens, however, were spared, at least as far as lay in the general's power; but many of them were put to the sword by the soldiers on their first entrance. In one quarter particularly, Amrou found them butchering the Alexandrians with unrelenting barbarity; to which, however, by his seasonable interposition, he put a stop, and on that spot erected a mosque, which he called the *mosque of mercy*.

From this time Alexandria never recovered its former splendour. It continued under the dominion of the caliphs, till the year 924, when it was taken by the Magrebians, two years after its great church had been destroyed by fire. This church was called by the Arabs *Al Kaisaria*, or *Cæsarea*; and had formerly been a pagan temple, erected in honour of Saturn by the famous Queen Cleopatra.

The city was soon after abandoned by the Magrebians; but in 928 they again made themselves masters of it. Their fleet being afterwards defeated by that belonging to the caliph, *Abul Kasem* the Magrebian general retired from Alexandria, leaving there only a garrison of 300 men; of which *Thmadl*, the caliph's admiral, being apprised, he in a few days appeared before the town, and carried off the remainder of the inhabitants to an island in the Nile called *Abukair*. This was done to prevent Abul Kâsem from meeting with any entertainment at Alexandria, in case he should think proper to return. According to Eutychius, above 200,000 of the miserable inhabitants perished this year.

What contributed to raise Alexandria to such a prodigious height of splendour as it enjoyed for a long time, was its being the centre of commerce between the eastern and western parts of the world. It was with the view of becoming master of this lucrative trade, that Alexander built this city, after having extirpated the

Tyrians who formerly engrossed all the East India traffic. Of the immense riches which that trade afforded, we may form an idea, from considering that the Romans accounted it a point of policy to oppress the Egyptians, especially the Alexandrians; and after the defeat of Zenobia, there was a single merchant of Alexandria who undertook to raise and pay an army out of the profits of his trade. The Greek emperors drew prodigious tributes from Egypt, and yet the caliphs found their subjects in so good circumstances as to screw up their revenues to three hundred millions of crowns.

Though the revolutions which happened in the government of Egypt, after it fell into the hands of the Mahometans; frequently affected this city to a very great degree; yet still the excellence of its port, and the innumerable conveniences resulting from the East India trade, to whomsoever were masters of Egypt, preserved Alexandria from total destruction, even when in the hands of the most barbarous nations. Thus, in the 13th century, when the barbarism introduced by the Goths, &c. began to wear off from the European nations, and they acquired a taste for the elegancies of life, the old mart of Alexandria began to revive; and the port, though far from recovering its former magnificence, grew once more famous by becoming the centre of commerce: but having fallen under the dominion of the Turks, and the passage round the Cape of Good Hope being discovered by the Portuguese in 1499, a fatal blow was given to the Alexandrian commerce, and the city has since fallen into decay.

At present, the city of Alexandria is reckoned to have about 14,000 or 15,000 inhabitants; a strange colluvies of different nations, as well as from various parts of the Turkish empire; but the most numerous classes are Copts, Turks, and Jews. They are in general given to thieving and cheating; and (like their predecessors) seditious above all others, were they not kept in awe by the severity of their government. The British and French carry on a considerable commerce with them, and have each a consul residing here. The subjects of those kingdoms which keep no consul here, are subjected to a tax by the Grand Signior: but the Jews have found out a method of indemnifying themselves for this disadvantage; namely, by selling their commodities cheaper than other foreigners can afford. They are also favoured by the farmers of the revenue; who know, that if they do not pay some private regard to them, the Jews have it in their power to cause fewer merchandises come into their port during the two years that their farm lasts.

The present city is a kind of peninsula situated between the two ports. That to the westward was called by the ancients the *Portus Eunostus*, now the *Old Port*, and is by far the best: Turkish vessels only are allowed to anchor there: the other, called the *New Port*, is for the Christians; at the extremity of one of the arms of which stood the famous Pharos. The New Port, the only harbour for Europeans, is clogged up with sand, insomuch that in stormy weather ships are liable to bilge; and the bottom being also rocky, the cables soon chafe and part; so that one vessel driving against a second, and that against a third, they are perhaps all lost. Of this there was a fatal instance some years ago, when 42 vessels were dashed to pieces on the mole

Alexandria, in a gale of wind from the north-west, and numbers have been since lost there at different times. If it be asked in Europe, why do they not repair the New Port? the answer is, That in Turkey they destroy every thing, and repair nothing. The old harbour will be destroyed likewise, as the ballast of vessels has been continually thrown into it for the last 200 years. The spirit of the Turkish government is to ruin the labours of past ages, and destroy the hopes of future times, because the barbarity of ignorant despotism never considers to-morrow.

In time of war, Alexandria is of no importance; no fortification is to be seen; even the Farillon, with its lofty towers, cannot be defended. It has not four cannon fit for service, nor a gunner who knows how to point them. The 500 janizaries, who should form the garrison, reduced to half that number, know nothing but how to smoke a pipe. But Alexandria is a place of which the conquest would be of no value. A foreign power could not maintain itself there, as the country is without water. This must be brought from the Nile by the kalidj, or canal of 12 leagues, which conveys it thither every year at the time of the inundation. It fills the vaults or reservoirs dug under the ancient city, and this provision must serve till the next year. It is evident, therefore, that were a foreign power to take possession, the canal would be shut, and all supplies of water cut off. It is this canal alone which connects Alexandria with Egypt; for from its situation without the Delta, and the nature of the soil, it really belongs to the deserts of Africa. Its environs are sandy, flat, and sterile, without trees and without houses; where we meet with nothing but the plant which yields the kali, and a row of palm trees which follows the course of the kalidj or canal.

The city is governed like others in the same kingdom. (See EGYPT.) It has a small garrison of soldiers, part of which are Janizaries and Assassins; who are very haughty and insolent, not only to strangers, but to the mercantile and industrious part of the people, though ever so considerable and useful. The government is so remiss in favour of these wretches, that Mr Norden informs us, one of them did not hesitate to kill a farmer of the customs, for refusing to take less of him than the duty imposed, and went off unpunished; it being a common salvo among them, that what is done cannot be undone.

The present condition of Alexandria is very despicable, being now so far ruined, that the rubbish in many places overtops the houses. The famous tower of Pharos has long since been demolished, and a castle, called *Farillon*, built in its place. The causeway which joined the island to the continent is broken down, and its place supplied by a strong bridge of several arches.

Some parts of the old walls of the city are yet standing, and present us with a masterpiece of ancient masonry. They are flanked with large towers, about 200 paces distant from each other, with small ones in the middle. Below are magnificent casemates, which may serve for galleries to walk in. In the lower part of the towers is a large square hall, whose roof is supported by thick columns of Thebaic stone. Above this are several rooms, over which there are platforms more than 20 paces square. The ancient reservoirs, vaulted

with so much art, which extend under the whole town, Alexandria, are almost entire at the end of 2000 years.

Of Cæsar's palace there remain only a few porphyry pillars, and the front, which is almost entire, and looks very beautiful. The palace of Cleopatra was built upon the walls facing the port, having a gallery on the outside, supported by several fine columns. Not far from this palace are two obelisks, vulgarly called *Cleopatra's Needles*. They are of Thebaic stone, and covered with hieroglyphics. One is overturned, broken, and lying under the sand; the other is on its pedestal. These two obelisks, each of them of a single stone, are about 60 feet high, by seven feet square at the base. Denon, who went to Egypt along with the French army in 1798, supposed that these columns decorated the entrance of the palace of the Ptolemies, the ruins of which still exist at no great distance from the place of the obelisks. Towards the gate of Rosetta, are five columns of marble on the place formerly occupied by the porticoes of the gymnasium. The rest of the colonnade, the design of which was discoverable 100 years ago by Maillet, has since been destroyed by the barbarism of the Turks.

But what most engages the attention of travellers is the pillar of Pompey, as it is commonly called, situated at a quarter of a league from the southern gate. It is composed of red granite. The capital is Corinthian, with palm leaves, and not indented. It is nine feet high. The shaft and the upper member of the base are of one piece of 90 feet long, and nine in diameter. The base is a square of about 15 feet on each side. This block of marble, 60 feet in circumference, rests on two layers of stone bound together with lead; which, however, has not prevented the Arabs from forcing out several of them, to search for an imaginary treasure. The whole column is 114 feet high. It is perfectly well polished, and only a little shivered on the eastern side. Nothing can equal the majesty of this monument; seen from a distance, it overtops the town, and serves as a signal for vessels. Approaching it nearer, it produces an astonishment mixed with awe. One can never be tired with admiring the beauty of the capital, the length of the shaft, nor the extraordinary simplicity of the pedestal. This last has been somewhat damaged by the instruments of travellers, who are curious to possess a relic of this antiquity; and one of the volutes of the column was immaturely brought down about twelve years ago, by a prank of some English captains, which is thus related by Mr Irwin.

These jolly sons of Neptune had been pushing about the can on board one of the ships in the harbour, until a strange freak entered into one of their brains. The eccentricity of the thought occasioned it immediately to be adopted; and its apparent impossibility was but a spur for the putting it into execution. The boat was ordered; and with proper implements for the attempt, these enterprising heroes pushed ashore, to drink a bowl of punch on the top of Pompey's pillar! At the spot they arrived; and many contrivances were proposed to accomplish the desired point. But their labour was in vain; and they began to despair of success, when the genius who struck out the frolic happily suggested the means of performing it. A man was dispatched

Alexandria, patched to the city for a paper kite. The inhabitants were by this time apprized of what was going forward, and flocked in crowds to be witnesses of the address and boldness of the English. The governor of Alexandria was told that these seamen were about to pull down Pompey's pillar. But whether he gave them credit for their respect to the Roman warrior, or to the Turkish government, he left them to themselves; and politely answered, that the English were too great patriots to injure the remains of Pompey. He knew little, however, of the disposition of the people who were engaged in this undertaking. Had the Turkish empire risen in opposition, it would not perhaps at that moment have deterred them. The kite was brought, and flown so directly over the pillar, that when it fell on the other side, the string lodged upon the capital. The chief obstacle was now overcome. A two-inch rope was tied to one end of the string, and drawn over the pillar by the end to which the kite was affixed. By this rope one of the seamen ascended to the top; and in less than an hour a kind of shroud was constructed, by which the whole company went up, and drank their punch amid the shouts of the astonished multitude. To the eye below, the capital of the pillar does not appear capable of holding more than one man upon it; but our seamen found it could contain no less than eight persons very conveniently. It is astonishing that no accident befel these madcaps, in a situation so elevated, that would have turned a landman giddy in his sober senses. The only detriment which the pillar received, was the loss of the volute before mentioned; which came down with a thundering sound, and was carried to England by one of the captains, as a present to a lady who commissioned him for a piece of the pillar. The discovery which they made amply compensated for this mischief; as without their evidence, the world would not have known at this hour that there was originally a statue on this pillar, one foot and ancle of which are still remaining. The statue must have been of a gigantic size; to have appeared of a man's proportion at so great a height.

There are circumstances in this story which might give it an air of fiction, were it not demonstrated beyond all doubt. Besides the testimonies of many eye-witnesses, the adventurers themselves have left us a token of the fact, by the initials of their names, which are very legible in black paint just beneath the capital.

Learned men and travellers have made many fruitless attempts to discover in honour of what prince it was erected. The best informed have concluded, that it could not be in honour of Pompey, since neither Strabo nor Diodorus Siculus have spoken of it. The Arabian Abulfeda, in his Description of Egypt, calls it the *Pillar of Severus*. And history informs us*, that this emperor "visited the city of Alexandria: That he granted a senate to its inhabitants, who until that time, under the subjection of a single Roman magistrate, had lived without any national council, as under the reign of the Ptolemies, when the will of the prince was their only law: That he did not confine his benefactions there; he changed several laws in their favour." This column, therefore, Mr Savary concludes to have been erected by the inhabitants as a mark of their gratitude to Severus. And in a Greek inscription, now half effaced, but visible on the west side when

the sun shines upon it, and which probably was legible in the time of Abulfeda, he supposes the name of Severus to have been preserved. He further observes, that this was not the only monument erected to him by the gratitude of the Alexandrians: for there is still seen in the midst of the ruins of Antinoë, built by Adrian, a magnificent pillar, the inscription on which is still remaining, dedicated to Alexander Severus.

Denon, whom we have already quoted, seems to be of a different opinion. "We passed (says he) near Pompey's pillar. This monument is in the predicament of almost every thing famous, which loses on a near scrutiny. It was named Pompey's pillar in the fifteenth century, when learning began to recover itself from the torpid state in which it had so long languished. At that epoch, men of science, but not observers, bestowed names on all the monuments; and these names have been handed down by tradition, and without being disputed, from century to century. A monument had been raised to Pompey at Alexandria: it had disappeared, and was thought to be recovered in this pillar or column, which has since been converted into a trophy erected to the memory of Septimius Severus. It is, however, placed on the ruins of the ancient city; and in the time of Septimius Severus, the city of the Ptolemies was not in a ruinous state. To support this column by a solid foundation, an obelisk has been sunk in the earth, on which is placed a very clumsy pedestal, having a fine shaft, and surmounted by a Corinthian capital of bad workmanship.

"If the shaft of this column, separating it from the pedestal and the capital, once belonged to an ancient edifice, it is an evidence of its magnificence, and of the skill with which it was executed. It ought therefore to be said, that what is called Pompey's pillar, is a fine column, and not a fine monument. It should be said, that the column of St Maria Maggiore, notwithstanding it is one of the finest in existence, has not the character of a monument; that it is merely a fragment; and that, if the columns of Trajan and Antoninus are not in the same predicament, it is because they appear as colossal cylinders, on which the history of the glorious expeditions of these two emperors is pompously displayed, and which, if reduced to their simple form and dimensions, would be nothing more than dull and heavy monuments.

"The earth about the foundation of Pompey's pillar having been cleared away by time, two fragments of an obelisk of white marble, the only monument of that substance which I have seen in Egypt, have been added to the original base, to render it more solid.

"Excavations made round the circumference of this column, would, no doubt, afford some information relative to its origin. The shaking of the earth, and the form it takes on treading on it, seem to attest that these researches would not be fruitless. They would perhaps discover the base and atrium of the portico to which this column belonged, which has been the subject of dissertations made by literati who have seen the drawings only, or whose information has been limited to the descriptions of travellers. These travellers have neglected to apprise them, that fragments of columns of the same substance and diameter are found in the vicinity; and that the shaking of the earth indicates the destruction of great edifices buried beneath, the forms of which

Alexandria. which may be distinguished on the surface, such as a square of a considerable size, and a large circus, the principal dimensions of which may be measured, notwithstanding it is covered with sand and ruins.

"After having observed that the column, entitled *Pompey's pillar*, is very chaste both in style and execution; that the pedestal and capital are not formed of the same granite as the shaft; that their workmanship is heavy, and appears to be merely a rough draught; and that the foundations, made up of fragments, indicate a modern construction; it may be concluded, that this monument is not antique, and that it may have been erected either in the time of the Greek emperors, or of the caliphs; since, if the capital and pedestal are well enough wrought to belong to the former of these periods, they are not so perfect, but that art may have reached so far in the latter." (*Denon's Travels.*)

On the south-west side of the city, at a mile's distance, are situated the catacombs, the ancient burial-place of Alexandria; and although they cannot be compared to those of the ancient Memphis, which the Arabs will not permit to be visited, in order to make the better market of their mummies, it is probable that, the method of embalming being the same, the form of these catacombs can only differ in their proportions. The Baron de Tott, in describing these, observes, "that Nature not having furnished this part of Egypt with a ridge of rocks, like that which runs parallel with the Nile above Delta, the ancient inhabitants of Alexandria could only have an imitation by digging into a bed of solid rock; and thus they formed *Necropolis*, or "City of the Dead." The excavation is from 30 to 40 feet wide, and 200 long, and 25 deep, and is terminated by gentle declivities at each end. The two sides, cut perpendicularly, contain several openings, about 10 or 12 feet in width and height, hollowed horizontally; and which form, by their different branches, subterranean streets. One of these, which curiosity has disencumbered from the ruins and sands that render the entrance of others difficult or impossible, contains no mummies, but only the places they occupied. The order in which they were ranged is still to be seen. Niches, 20 inches square, sunk six feet horizontally, narrowed at the bottom, and separated from each other by partitions in the rock, seven or eight inches thick, divided into checkers the two walls of this subterranean vault. It is natural to suppose, from this disposition, that each mummy was introduced with the feet foremost into the cell intended for its reception; and that new streets were opened, in proportion as these dead inhabitants of *Necropolis* increased." This observation, he adds, which throws a light on the catacombs of Memphis, may perhaps likewise explain the vast size and multitude, as well as the different elevations, of the pyramids in the Higher and Lower Egypt.

About 70 paces from Pompey's pillar is the khalis or the canal of the Nile, which was dug by the ancient Egyptians, to convey the water of the Nile to Alexandria, and fill the cisterns under the city. On the side of the khalis are gardens full of orange and lemon trees, and the fields are full of caper and palm trees. On the top of a hill is a tower, on which a sentinel is always placed, to give notice, by means of a flag, of the ships that are coming into the port.

From this hill may be seen the sea, the whole extent of the city, and the parts round it.

In going along the sea coast, there is a large bason cut out of the rock that lines the shore. On the sides of this bason, two beautiful saloons are hewn out by the chisel, with benches that run across them. A canal made zig-zag, for the purpose of stopping the sand by its different windings, conveys into them the water of the sea, as pure and transparent as crystal. Seated on the stone-bench, the water rises a little above the waist; while the feet softly repose on a fine sand. The waves of the sea are heard roaring against the rock, and foaming in the canal. The swell enters, raises you up, and leaves you; and thus alternately entering and retiring, brings a continual fresh supply of water, and a coolness which is truly delicious under a burning sky. This place is vulgarly called the *Bath of Cleopatra*. Some ruins announce that it was formerly ornamented.

In 1798 Alexandria was taken by the French under the command of Bonaparte. It fell into the hands of the British army in the year 1801; but by an article in the treaty of peace, was restored to the Ottoman Porte. It was taken possession of again by the British in 1806, but abandoned soon after.

Alexandria is about 50 leagues north of Cairo. E. Long. 31. 15. N. Lat. 31. 12.

ALEXANDRIA, a strong and considerable city of Italy, belonging to the duchy of Milan, with a good castle, built in 1178 in honour of Pope Alexander III. This pope made it a bishopric, with several privileges and exemptions. Prince Eugene of Savoy took this city in 1706, after three days siege. The French took it in 1745; but the king of Sardinia, to whom it belongs by the treaty of Utrecht, retook it in 1746. The fortifications of the town are trifling, but the citadel is considerable. It is fifteen miles south-east of Cassal, thirty-five north-by-west of Genoa, and forty south-by-west of Milan. E. Long. 8. 40. N. Lat. 44. 53. The country about this town is called the *Alexandrin*.

ALEXANDRIA, in *Ancient Geography*, a city of Arachosia, called also *Alexandropolis*, on the river Arachotus (Stephanus, Isidorus Characenus).—Another *Alexandria* in Gedrosia, built by Leonatus, by order of Alexander (Pliny).—A third *Alexandria* in Aria, situated at the lake Arias (Ptolemy); but, according to Pliny, built by Alexander on the river Arius.—A fourth in Bactriana (Pliny).—A fifth *Alexandria*, an inland town of Carmania (Pliny, Ptolemy, Ammian).—A sixth *Alexandria*, or *Alexandropolis*, in Sogdiana (Isidorus Characenus).—A seventh in India at the confluence of the Acesines and Indus (Arrian).—An eighth, called also *Alexandretta*, near the Sinus Issicus, on the confines of Syria and Cilicia, now *Scanderoon* (see ALEXANDRETTA), the port town to Aleppo.—A ninth *Alexandria* of Margiana, which being demolished by the barbarians, was rebuilt by Antiochus the son of Seleucus, and called *Antiochia* of Syria (Pliny); watered by the river Margus, which is divided into several channels, for the purpose of watering the country which was called *Zotale*. The city was seventy stadia in circuit, according to Pliny; who adds, that, after the defeat of Crassus, the captives were conveyed to this place by Orodes, the king of the

the Parthians.—A tenth, of the Oxiana, built on the Oxus by Alexander, on the confines of Bactria (Pliny.)—An eleventh, built by Alexander at the foot of Mount Paropamisus, which was called *Caucasus* (Pliny, Arrian.)—A twelfth *Alexandria* in Troas, called also *Troas* and *Antigonia* (Pliny).—A thirteenth on the Iaxartes, the boundary of Alexander's victories towards Scythia, and the last that he built on that side.

ALEXANDRIAN, in a particular sense, is applied to all those who professed or taught the sciences in the school of Alexandria. In this sense, Clemens is denominated *Alexandrinus*, though born at Athens. The same may be said of Apion, who was born at Oasis; and Arostarchus, by birth a Samothracian. The chief Alexandrian philosophers were, Amonius, Plotinus, Origen, Porphyry, Jamblicus, Sopater, Maximus, and Dexippus.

ALEXANDRIAN is more particularly understood of a college of priests, consecrated to the service of Alexander Severus after his deification. Lampridius relates, that, notwithstanding Severus was killed by Maximin, the senate prosecuted his apotheosis; and, for regularity of worship, founded an order of priests, or *sodales*, under the denomination of *Alexandrini*.

ALEXANDRIAN Manuscript, a famous copy of the Scriptures, consisting of four volumes, in a large quarto size; which contains the whole Bible in Greek, including the Old and New Testament, with the Apocrypha, and some smaller pieces, but not quite complete. This manuscript is now preserved in the British Museum. It was sent as a present to King Charles I. from Cyrillus Lucaris, patriarch of Constantinople, by Sir Thomas Rowe, ambassador from England to the Grand Signior, about the year 1628. Cyrillus brought it with him from Alexandria, where probably it was written. In a schedule annexed to it, he gives this account: That it was written, as tradition informed them, by Thecla, a noble Egyptian lady, about 1300 years ago, not long after the council of Nice. But this high antiquity, and the authority of the tradition to which the patriarch refers, have been disputed; nor are the most accurate Biblical writers agreed about its age. Grabe thinks that it might have been written before the end of the fourth century; others are of opinion, that it was not written till near the end of the fifth century, or somewhat later.

ALEXANDRIAN, or *Alexandrine*, in Poetry, a kind of verse consisting of twelve, or of twelve and thirteen syllables alternately; so called from a poem on the life of Alexander written in this kind of verse by some French poet. Alexandrines are peculiar to modern poetry, and seem well adapted to epic poems. They are sometimes used by most nations of Europe; but chiefly by the French, whose tragedies are generally composed of Alexandrines.

ALEXICACUS, something that preserves the body from harm or mischief. The word amounts to much the same as *alexiterial*.

ALEXICACUS, in antiquity, was an attribute of Neptune, whom the tunny-fishers used to invoke under this appellation, that their nets might be preserved from the *xiacus*, or sword-fish, which used to tear them; and that he might prevent the assistance which it was pretended the dolphins used to give the tunnies on this occasion.

ALEXIPHARMICS, in Medicine, are properly remedies for expelling or preventing the ill effects of poison: but some of the moderns having imagined that the animal spirits in acute distempers were affected by a malignant poison, the term has been understood to mean medicines adapted to expel this poison by the cutaneous pores, in the form of sweat. In this sense, alexipharmics are the same as sudorifics.

ALEXIS, a Piedmontese. There is a book of "Secrets," which for a long time has gone under his name. It was printed at Basil 1536, in 8vo, and translated from Italian into Latin by Wecher; it has also been translated into French, and printed several times with additions. There is a preface to the piece, wherein Alexis informs us, that he was born of a noble family; that he had from his most early years applied himself to study; that he had learned many languages; that having an extreme curiosity to be acquainted with the secrets of nature, he had collected as much as he could during his travels for 57 years; that he piqued himself upon not communicating his secrets to any person; but that when he was 82 years of age, having seen a poor man who had died of a sickness which might have been cured had he communicated his secret to the surgeon who took care of him, he was touched with such a remorse of conscience, that he lived almost like a hermit: and it was in this solitude that he arranged his secrets in such order as to make them fit to be published. The hawkers generally carry them, with other books, to the country fairs. These, however, contain only his select remedies, not his entire collection.

ALEXITERIAL, among physicians, a term of much the same import with *alexipharmic*; though sometimes used in a synonymous sense with amulet.

ALEYN, CHARLES, an English poet in the reign of Charles I. In 1631, he published two poems, entitled, "The Battails of Cressy and Poitiers, under the fortunes and valour of King Edward of that name, and his sonne Edward prince of Wales, named the Black." He succeeded his father as clerk of the ordnance, and was commissary-general of the artillery to the king at the battle of Edgehill. The next piece he wrote was a poem in honour of Henry VII. and the victory that gained him the crown of England. In 1639, the year before he died, he translated the history of Eurialis and Lucretian, from the Latin epistles of Æneas Sylvius.

ALFANDIGA, the name of the customhouse at Lisbon.

ALFAQUES, among the Moors, the name generally used for their clergy, or those who teach the Mahometan religion; in opposition to the Morabites, who answer to monks among Christians.

ALFARABIUS, an eastern philosopher of the 10th century. See SUPPLEMENT.

ALFATERNA, in Ancient Geography, the last town of Campania, beyond Vesuvius (Diodorus); the same with NOCERA, which see. The inhabitants *Alfaterni* (Pliny).

ALFDOUCH, a name given by the Moors to a sort of vermicelli, which they make of flour and water, and are very fond of in their entertainments.

ALFERGAN, or ALFRAGAN, an Arabian astronomer. See SUPPLEMENT.

ALFET, in our old customs, denotes a caldron full

Alexipharmics
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Alfet.

Alfred
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Alfred.

full of boiling water, wherein an accused person, by way of trial or purgation, plunged his arm up to the elbow.

ALFIERI, VICTOR, an Italian dramatic writer. See SUPPLEMENT.

ALFORD, a town of Lincolnshire, situated on a small brook that runs through the town. A salt spring was discovered here in 1670, from the pigeons which flew thither in great numbers to drink the water; those birds being known to be fond of salt. It contains a strong purging salt, together with a portion of sea-salt. It is recommended as cooling, cleansing, and attenuating, as a good remedy in the scurvy, jaundice, and other glandular obstructions. The town contained 1169 inhabitants in 1810. It is six miles from the sea. E. Long. o. 15. N. Lat. 53. 30.

ALFRED, or **ÆLFRED**, the Great, king of England, was the fifth and youngest son of Æthelwolf king of the West Saxons, and was born at Wantage in Berkshire in 849. He distinguished himself, during the reign of his brother Ethelred, in several engagements against the Danes; and upon his death succeeded to the crown, in the year 871, and the 22d of his age. At his ascending the throne, he found himself involved in a dangerous war with the Danes, and placed in such circumstances of distress as called for the greatest valour, resolution, and all the other virtues with which he was adorned. The Danes had already penetrated into the heart of his kingdom; and before he had been a month upon the throne, he was obliged to take the field against those formidable enemies. After many battles gained on both sides, he was at length reduced to the greatest distress, and was entirely abandoned by his subjects. In this situation, Alfred, conceiving himself no longer a king, laid aside all marks of royalty, and took shelter in the house of one who kept his cattle. He retired afterwards to the isle of Æthelingey in Somersetshire, where he built a fort for the security of himself, his family, and the few faithful servants who repaired thither to him. When he had been about a year in this retreat, having been informed that some of his subjects had routed a great army of the Danes, killed their chief, and taken their magical standard (A), he issued his letters, giving notice where he was, and inviting his nobility to come and consult with him. Before they came to a final determination, Alfred, putting on the habit of a harp-

er, went into the enemy's camp, where, without suspicion, he was everywhere admitted, and had the honour to play before their princes. Having thereby acquired an exact knowledge of their situation, he returned in great secrecy to his nobility, whom he ordered to their respective homes, there to draw together each man as great a force as he could; and upon a day appointed there was to be a general rendezvous at the great wood called *Selwood*, in Wiltshire. This affair was transacted so secretly and expeditiously, that, in a little time, the king, at the head of an army, approached the Danes, before they had the least intelligence of his design. Alfred, taking advantage of the surprise and terror they were in, fell upon them, and totally defeated them at Æthendune, now Eddington. Those who escaped fled to a neighbouring castle, where they were soon besieged, and obliged to surrender at discretion. Alfred granted them better terms than they could expect. He agreed to give up the whole kingdom of the East Angles to such as would embrace the Christian religion, on condition they would oblige the rest of their countrymen to quit the island, and, as much as it was in their power, prevent the landing of any more foreigners. For the performance thereof he took hostages: and when in pursuance of the treaty, Guthrum the Danish captain came, with 30 of his chief officers, to be baptized, Alfred answered for him at the font, and gave him the name of *Æthelstane*; and certain laws were drawn up betwixt the king and Guthrum for the regulation and government of the Danes settled in England. In 884, a fresh number of Danes landed in Kent, and laid siege to Rochester, but the king coming to the relief of that city, they were obliged to abandon their design. Alfred had now great success; which was chiefly owing to his fleet, an advantage of his own creating. Having secured the sea-coasts, he fortified the rest of the kingdom with castles and walled towns; and he besieged and recovered from the Danes the city of London, which he resolved to repair, and to keep as a frontier (B).

After some years respite, Alfred was again called into the field: for a body of Danes, being worsted in the west of France, came with a fleet of 250 sail on the coast of Kent; and having landed, fixed themselves at Appletree: shortly after, another fleet of 80 vessels coming up the Thames, the men landed, and built a fort at Middleton. Before Alfred marched against the enemy,

Alfred.

(A) "This (says Sir John Spelman) was a banner, with the image of a raven magically wrought by the three sisters of Hinguar and Hubba, on purpose for their expedition, in revenge of their father Lodebroch's murder, made, they say, almost in a instant, being by them at once begun and finished in a noontide, and believed by the Danes to have carried great fatality with it, for which it was highly esteemed by them. It is pretended, that, being carried in battle, towards good success it would always seem to clap its wings, and make as if it would fly; but towards the approach of mishap, it would hang down and not move." (*Life of Alfred*, p. 61.)

(B) The Danes had possessed themselves of London in the time of his father, and had held it till now as a convenient place for them to land at, and fortify themselves in; neither was it taken from them but by a close siege. However, when it came into the king's hands, it was in a miserable condition, scarce habitable, and all its fortifications ruined. The king, moved by the importance of the place, and the desire of strengthening his frontier against the Danes, restored it to its ancient splendour. And observing, that through the confusion of the times, many, both Saxons and Danes, lived in a loose disorderly manner, without owing any government, he offered them now a comfortable establishment, if they would submit and become his subjects. This proposition was better received than he expected; for multitudes growing weary of a vagabond kind of life, joyfully accepted such an offer. (*Chron. Sax.* p. 88.)

red. enemy, he obliged the Danes, settled in Northumberland and Essex, to give him hostages for their good behaviour. He then moved towards the invaders, and pitched his camp between their armies, to prevent their junction. A great body, however, moved off to Essex; and crossing the river, came to Farnham in Surry, where they were defeated by the king's forces. Mean while, the Danes settled in Northumberland, in breach of treaty, and notwithstanding the hostages given, equipped two fleets; and, after plundering the northern and southern coasts, sailed to Exeter, and besieged it. The king, as soon as he received intelligence, marched against them; but, before he reached Exeter, they had got possession of it. He kept them, however, blocked up on all sides; and reduced them at last to such extremities, that they were obliged to eat their horses, and were even ready to devour each other. Being at length rendered desperate, they made a general sally on the besiegers; but were defeated, though with great loss on the king's side. The remainder of this body of Danes fled into Essex, to the fort they had built there, and to their ships. Before Alfred had time to recruit himself, another Danish leader, whose name was Laf, came with a great army out of Northumberland, and destroyed all before him, marching on to the city of Werheal in the west, which is supposed to be Chester, where they remained the rest of that year. The year following they invaded North Wales; and after having plundered and destroyed every thing, they divided, one body returning to Northumberland, another into the territories of the East Angles; from whence they proceeded to Essex, and took possession of a small island called *Meresig*. Here they did not long remain; for having separated, some sailed up the river Thames, and others up the Lea road; where, drawing up their ships, they built a fort not far from London, which proved a great check upon the citizens, who went in a body and attacked it, but were repulsed with great loss: at harvest time the king himself was obliged to encamp with a body of troops in the neighbourhood of the city, in order to cover the reapers from the excursions of the Danes. As he was one day riding by the side of the river Lea, after some observations he began to think that the Danish ships might be laid quite dry; this he attempted, and succeeded; so that the Danes deserted their fort and ships, and marched away to the banks of the Severn, where they built a fort, and wintered at a place called *Quatbrig* (c). Such of the Danish ships as could be got off, the Londoners carried into their own road; the rest they burnt and destroyed.

Alfred enjoyed a profound peace during the three last years of his reign, which he chiefly employed in establishing and regulating his government, for the security of himself and his successors, as well as the ease and benefit of his subjects in general. After a troublesome reign of 28 years, he died on the 28th of October

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†

A. D. 900; and was buried at Winchester, in Hyde-abbey, under a monument of porphyry.

Alfred.

All our historians agree in distinguishing him as one of the most valiant, wisest, and best of kings that ever reigned in England; and it is also generally allowed, that he not only digested several particular laws still in being, but that he laid the first foundation of our present happy constitution. There is great reason to believe that we are indebted to this prince for trials by juries; and the Domesday book, which is preserved in the exchequer, is thought to be no more than another edition of Alfred's book of Winchester, which contained a survey of the kingdom. It is said also, that he was the first who divided the kingdom into shires. What is ascribed to him is not a bare division of the country, but the settling a new form of judicature; for after having divided his dominions into shires, he subdivided each shire into three parts, called *trythings*. There are some remains of this ancient division in the ridings of Yorkshire, the laths of Kent, and the three parts of Lincolnshire. Each *trything* was divided into hundreds or wapentakes; and these again into *tythings* or dwellings of ten householders: each of these householders stood engaged to the king, as a pledge for the good behaviour of his family, and all the ten were mutually pledges for each other; so that if any one of the *tythings* was suspected of an offence, if the head-boroughs or chiefs of the *tythings* would not be security for him, he was imprisoned; and, if he made his escape, the *tything* and hundred were fined to the king. Each shire was under the government of an earl, under whom was the reive, his deputy; since, from his office, called *shire-reive*, or *sheriff*. And so effectual were these regulations, that it is said he caused bracelets of gold to be hung up in the highways, as a challenge to robbers; and they remained untouched.

In private life, Alfred was the most amiable man in his dominions: of so equal a temper, that he never suffered either sadness or unbecoming gaiety to enter his mind; but appeared always of a calm yet cheerful disposition, familiar to his friends, just even to his enemies, kind and tender to all. He was a remarkable economist of his time; and Asserius has given us an account of the method he took for dividing and keeping an account of it: he caused six wax-candles to be made each of 12 inches long, and of as many ounces weight; on the candles the inches were regularly marked, and having found that one of them burnt just four hours, he committed them to the care of the keepers of his chapel, who from time to time gave him notice how the hours went: but as in windy weather the candles were wasted by the impression of the air on the flame, to remedy this inconvenience, he invented lanthorns, there being then no glass in his dominions.

This prince, we are told, was 12 years of age before a master could be procured in the western kingdom

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(c) The king's contrivance is thought to have produced the meadow between Hertford and Bow; for at Hertford was the Danish fort, and from thence they made frequent excursions on the inhabitants of London. Authors are not agreed as to the method the king pursued in laying dry the Danish ships: Dugdale supposes that he did it by straightening the channels; but Henry of Huntingdon alleges, that he cut several canals, which exhausted its water.

Alfred.

to teach him the alphabet; such was the state of learning when Alfred began to reign. He had felt the misery of ignorance; and determined even to rival his contemporary Charlemagne in the encouragement of literature. He is supposed to have appointed persons to read lectures at Oxford, and is thence considered as the founder of that university. By other proper establishments, and by a general encouragement to men of abilities, he did every thing in his power to diffuse knowledge throughout his dominions. Nor was this end promoted more by his countenance and encouragement than by his own example and his writings. For notwithstanding the lateness of his initiation, he had acquired extraordinary erudition; and, had he not been illustrious as a king, he would have been famous as an author. His works are, 1. *Breviarium quoddam collectum ex Legibus Trojanorum*, &c. lib. i. A Breviary collected out of the laws of the Trojans, Greeks, Britons, Saxons, and Danes, in one book. Leland saw this book in the Saxon tongue, at Christ-church in Hampshire. 2. *Visi-Saxonum Leges*, lib. i. The laws of the West-Saxons, in one book. Pitts tells us, that it is in Bennet College library, at Cambridge. 3. *Instituta quædam*, lib. i. Certain Institutes, in one book. This is mentioned by Pitts, and seems to be the second capitulation with Guthrum. 4. *Contra Judices iniquos*, lib. i. An invective against Unjust Judges, in one book. 5. *Acta Magistratum suorum*, lib. i. Acts of his Magistrates, in one book. This is supposed to be the Book of Judgments mentioned by Horne; and was, in all probability, a kind of Reports, intended for the use of succeeding ages. 6. *Regum fortune varicæ*, lib. i. The various Fortunes of Kings, in one book. 7. *Dicta Sapientum*, lib. i. The sayings of Wise Men, in one book. 8. *Parabolæ et Sales*, lib. i. Parables and pleasant Sayings, in one book. 9. *Collectiones Chronicorum*, Collection of Chronicles. 10. *Epistolæ ad Wulfsigum Episcopum*, lib. i. Epistles to Bishop Wulfsig, in one book. 11. *Manuale Meditationum*. A Manual of Meditations.—Besides those original works, he translated many authors from the Latin, &c. into the Saxon language, viz. 1. Bede's History of England. 2. Paulinus Orosius's History of the Pagans. 3. St Gregory's Pastoral, &c. The first of these, with his prefaces to the others, together with his laws, were printed at Cambridge, 1644. His laws are likewise inserted in Spelman's Councils. 4. *Boethius de Consolatione*, lib. v. Boetius's Consolations of Philosophy, in five books. Dr Plot tells us, King Alfred translated it at Woodstock, as he found in a MS. in the Cotton Library. 5. *Æsopi Fabulæ*, Æsop's Fables: which he is said to have translated from the Greek both into Latin and Saxon. 6. *Psalterium Davidicum*, lib. i. David's Psalter, in one book. This was the last work the king attempted, death surprising him before he had finished it; it was, however, completed by another hand, and published at London in 1640, in quarto, by Sir John Spelman. Several others are mentioned by Malmesbury; and the old history of Ely asserts, that he translated the Old and New Testaments.

The life of this great king was first written by Asse-rius Menevensis; and first published by Archbishop Parker, in the old Saxon character, at the end of his edition of Hassingham's history, printed in 1674, fol.

ALGA, in *Botany*, the trivial name of the lichen, fungus, and several other plants of the cryptogamia class.

ALGÆ, FLAGS; one of the seven families or natural tribes into which the whole vegetable kingdom is divided by Linnæus, in his *Philosophia Botanica*. They are defined to be plants, whose root, leaf, and stem, are all one. Under this description are comprehended all the sea-weeds, and some other aquatic plants. In the sexual system, they constitute the 3d order of the 24th class, *Cryptogamia*; in Tournefort, the second genus of the second section, *Marinæ, aut Fluviatiles*, of the 17th class, *Asperma vulgo habitæ*; and the 57th order in Linnæus's Fragments of a Natural Method. The discoveries made in this part of the vegetable kingdom are uncertain, and imperfect; and the attempts, in particular, to arrange flags by the parts of the fructification, have not been attended with great success. Dillenius has arranged this order of plants from their general habit and structure; Michelius from the parts of fructification.

ALGAGIOLA, a small sea-port town in the island of Corsica, fortified with walls and bastions. It was almost destroyed by the malecontents in 1731, but has since been repaired. E. Long. 9. 45. N. Lat. 42. 20.

ALGAROTH, in *Chemistry*, is a white oxyde of antimony, which is obtained by washing the butter or oxymuriate with pure water. See *CHEMISTRY Index*.

ALGAROTTI, COUNT, a celebrated Italian, was born at Padua; but the year is not mentioned. Led by curiosity, as well as a desire of improvement, he travelled early into foreign countries; and was very young when he arrived in France in 1736. Here he composed his "Newtonian Philosophy for the Ladies;" as Fontenelle had done his Cartesian Astronomy, in the work entitled "The Plurality of Worlds." He was noticed by the king of Prussia, who gave him marks of the esteem he had for him. He died at Pisa the 23d of May, 1764; and ordered his own mausoleum, with this inscription to be fixed upon it: "*Hic jacet Algarottus, sed non omnis*." He is allowed to have been a very great connoisseur in painting, sculpture, and architecture. He contributed much to the reformation of the Italian opera. His works, which are numerous, and upon a variety of subjects, abound with vivacity, elegance, and wit: a collection of them has lately been made, and printed at Leghorn in 1765, in 4 vols. 8vo.

ALGARVA, a province in the kingdom of Portugal, 67 miles in length and 20 in breadth; bounded on the west and south by the sea, on the east by the river Gnadiana, and on the north by Alentejo. It is very fertile in figs, almonds, dates, olives, and excellent wines; and, besides, has a very abundant and lucrative fishery. The capital town is Pharo. It contains four cities, 12 towns, 67 parishes, and, it is said, above 96,000 inhabitants.

Alfred
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Algarva

A L G E B R A.

INTRODUCTION.

History. 1. **A**LGEBRA is a general method of reasoning, concerning the relations which magnitudes of every kind bear to each other in respect of quantity. It is sometimes called *universal arithmetic*; its first principles and operations being similar to those of common arithmetic. The symbols which it employs to denote magnitudes are, however, more general and more extensive in their application than those employed in that science; hence, and from the great facility with which the various relations of magnitudes to one another may be expressed, by means of a few signs or characters, the application of algebra to the resolution of problems is much more extensive than that of common arithmetic.

2. There are various opinions as to the etymology of the name *algebra*. It is pretty certain, however, that the word is Arabic, and that from the Arabians the name, as well as the art itself, is derived. Lucas de Burgo, the first European author whose treatise on algebra was printed, calls it by the Arabic name *Alghebra e Almucabala*, which is explained to denote the art of *restitution* and *comparison*, or *opposition* and *comparison*, or *resolution* and *equation*, all which agree well enough with the nature of this art. Besides this etymology of the name *algebra*, several others have been imagined; that, however, which we have just now given seems to be the most probable of any hitherto assigned.

3. The origin of algebra, as well as that of most other branches of mathematical science, is involved in obscurity; there are indeed traces of it to be found in the works of some of the earliest philosophers and mathematicians, the subject of whose writings must necessarily have led them to the discovery, and, in some measure, to the application of this science.

4. The oldest treatise of algebra, which has come down to the present times, was written by Diophantus of Alexandria, who flourished about the year 350 after Christ, and who wrote 13 books on algebra or arithmetic in the Greek language: though only six of these have hitherto been printed, and one book, which is imperfect, on multangular numbers. It was not, however, from this author, but from the Moors or Arabians, that this, as well as most other sciences, was received in Europe; and some writers are of opinion, that they again received it from the Greeks; while others suppose that they had it from the Persians, and that these last derived algebra, as well as the arithmetical method of computing by ten characters or digits, from the Indians.

5. The Arabians themselves say, that it was invented by Mahomet ben Musa or son of Moses, who it seems flourished about the 8th or 9th century. It seems more probable that Mahomet was not the inventor, but only a person well skilled in the art; and that the Arabians received their knowledge of it from Diophantus, or other Greek writers, as they did that

of geometry and some other sciences, which they improved and translated into their own language. History.

6. However this may be, it seems to be pretty certain, that the science was first brought to Europe about the beginning of the 15th century, by Leonardus Pisanus, who travelled into Arabia and other eastern countries for the purpose of acquiring mathematical knowledge; and, in a short time, it began to be cultivated in Italy, where it was called *l'Arte Maggiore*, "the greater art," to distinguish it from common arithmetic, which was called *l'Arte Minore*, "the lesser art." It was also known in that country by the name *Regola de la Cosa*, or "rule of the thing," where by *Cosa*, or *the thing*, was meant the first or simple power of the unknown quantity.

7. Between the years 1470 and 1487, Lucas Paciols, or Lucas de Burgo, a Cordelier, or Minorite friar, published several treatises on arithmetic, algebra, and geometry; and, in 1494, his principal work, entitled *Summa de Arithmetica Proportioni et Proportionalita* was printed. The part of this work which relates to algebra, and which he calls *l'Arte Maggiore; ditta dal vulgo la Regola de la Cosa over Alghebra e Almucabala*, may be considered as exhibiting a pretty accurate state of the science, as it was then known in Europe; and probably it was much the same in Africa and Asia, from whence the Europeans derived the knowledge of it. It appears from this work, that their knowledge extended no farther than quadratic equations, of which they used only the positive roots; that they used only one unknown quantity: that they used no marks nor signs for either quantities or operations, excepting a few abbreviations of the words or names themselves; and that the art was only employed in the resolution of certain numeral problems. So that either the Africans had not carried algebra beyond quadratic equations; or else (what indeed is not improbable) the Europeans had not learned the whole of the art, as it was then known to the former.

8. After the publication of the books of Lucas de Burgo, algebra became more generally known and improved, especially in Italy; for about the year 1505, Scipio Ferreus, who was then professor of mathematics at Bononia, found out a rule for resolving one case of a compound cubic equation; but, as it appears to have been the custom of the times with respect to such matters, he kept the rule a profound secret from his contemporaries. The same thing was afterwards discovered in 1535 by Nicolas Tartalea, who then resided in Venice, and who had five years before found the resolution of two other cases of cubic equations.

9. The next work upon algebra which was printed after the books of Lucas de Burgo, was written by Hieronymus Cardan, of Bononia, a very learned man, who published in 1539 his arithmetical writings, in nine books, at Milan, where he practised physic, and read public lectures on mathematics. The same author in 1545 published a tenth book, containing the whole doctrine of cubic equations, which had been in part communicated to him under an oath of secrecy

History.

by Tartalea, but which, notwithstanding this circumstance, Cardan thought proper to publish, alleging (not altogether without reason) that he had made so many additions to Tartalea's discovery as to render it in a manner his own. Accordingly we find, that even to the present times, the common rule for resolving cubic equations is generally known by the name of Cardan's rule, although it would certainly be more just to attribute it to its first inventor, Tartalea.

10. Equations of the fourth order appear to have been first resolved by Lewis Ferrari, a disciple of Cardan's; and different methods of resolution were afterwards given by Descartes and others. This indeed is the greatest length that mathematicians have been able to carry the resolution of equations; for, with respect to those of the fifth, and all higher degrees, all attempts to resolve them, except in particular cases, have hitherto been found impracticable.

11. After this period, writers on algebra became more numerous; and many improvements were gradually made, both in the notation and in the theory of the science. Among other writers who cultivated it with success may be reckoned Bombelli, another Italian mathematician; Stifelius and Scheubelins, both of Germany; Robert Recorde, an English mathematician; and many others.

12. Among the mathematicians to whom algebra is particularly indebted, it is proper to mention Francis Vieta, a native of France, who wrote about the year 1600. Among various improvements in all parts of the science, he first introduced the general use of the letters of the alphabet, to denote indefinite given quantities, which, before his time, had only been done in some particular cases. The English mathematician, Harriot, deserves also to be particularly mentioned. His algebra, which was published after his death, in 1631, shews that he cultivated that science with great success. For, besides improving the notation, so as to render it nearly the same as it is at present, he first explained clearly a most important proposition in the theory of equations, namely, that an equation of any degree may be considered as produced by the continual multiplication of as many simple equations as there are units in the exponent of the highest power of the unknown quantity in that equation: Hence he shewed the relation which subsists between the coefficients of the terms of an equation and its roots.

13. Without mentioning all the writers on algebra who flourished about this time, and who severally contributed more or less to its improvement, we proceed to observe, that nothing has contributed more to the advancement of every branch of mathematical knowledge than the happy application which the celebrated philosopher Descartes made of algebra to the science of geometry; for his geometry, first published in 1637, may be considered rather as the application of algebra to geometry than as either algebra or geometry taken by itself as a science. Besides this happy union effected between the two sciences, Descartes contributed much to the improvement of both; and indeed he may be considered as having paved the way for all the discoveries which have since been made in mathematics.

14. After the publication of Descartes's Geometry, the science of algebra may be considered as having at-

tained some degree of perfection. It has, however, received many improvements from later writers, who, pursuing the paths struck out by Harriot and Descartes, having produced many new and beautiful theories, both in algebra and geometry. The writers upon algebra from this time became too numerous, and the respective improvements made by each too minute, to be particularly noticed in this introduction. It is, however, necessary to mention another mathematician, to whom algebra lies under considerable obligations, namely, M. Fermat, who may be considered as the rival of Descartes; for it appears that he was in possession of the method of applying algebra to the improvement of geometry before the publication of the celebrated work of the latter philosopher. Besides, Fermat appears to have been deeply versed in the theory of indeterminate problems; and he republished the oldest and most esteemed treatise upon that subject which is known, namely, Diophantus's Arithmetic, to which he added many valuable notes of his own.

15. Having now given a brief account of the origin of algebra, and of the writers who contributed the most to bring it to the state of perfection it had attained about the middle of the 16th century, which indeed was considerable, we shall conclude this introduction, by observing, that although its progress has since been very gradual, it has been upon the whole considerably improved; particularly by the labours of these foreign mathematicians, Schooten, Hudde, Van-Heuraet, De Witte, Slusius, Huygens, &c. As to the algebraical writers of our own country, those whose labours have been most conspicuous were Wallis, and more especially Sir Isaac Newton, to whom, among other things, we owe the invention of the binomial theorem: also Pell, Barrow, Kersey, Halley, Raphson, and many others. We now proceed to explain the science itself.

Notation and Explanation of the Signs.

16. In arithmetic there are ten characters, which being variously combined, according to certain rules, serve to denote all magnitudes whatever. But this method of expressing quantities, although of the greatest utility in every branch of the mathematics (for we must always have recourse to it in the different applications of that science to practical purposes), is yet found to be inadequate, taken by itself, to the more difficult cases of mathematical investigation; and it is therefore necessary, in many inquiries concerning the relations of magnitude, to have recourse to that more general mode of notation, and more extensive system of operations, which constitute the science of algebra.

17. In algebra quantities of every kind may be denoted by any characters whatever, but those commonly used are the letters of the alphabet: And as in every mathematical problem, there are certain magnitudes given, in order to determine other magnitudes, which are unknown, the first letters of the alphabet *a, b, c*, &c. are used to denote known quantities, while those to be found are represented by *v, x, y*, &c. the last letters of the alphabet.

18. The sign $+$ (*plus*) denotes that the quantity before which it is placed is to be added to some other quantity. Thus $a+b$ denotes the sum of *a* and *b*; $3+5$ denotes the sum of 3 and 5, or 8.

19. The

otation. 19. The sign — (*minus*) signifies that the quantity before which it is placed is to be subtracted. Thus $a-b$ denotes the excess of a above b ; $6-2$ is the excess of 6 above 2, or 4.

20. Quantities which have the sign + prefixed to them are called *positive* or *affirmative*; and such as have the sign — are called *negative*.

When quantities are considered abstractedly, the terms *positive* and *negative* can only mean that such quantities are to be added or subtracted; for as it is impossible to conceive a number less than 0, it follows, that a negative quantity by itself is unintelligible. But, in considering the affections of magnitude, it appears, that in many cases, a certain opposition may exist in the nature of quantities. Thus, a person's property may be considered as a positive quantity, and his debts as a negative quantity. Again, any portion of a line drawn to the right hand may be considered as positive, while a portion of the same line, continued in the opposite direction, may be taken as negative.

When no sign is prefixed to a quantity, + is always understood, or the quantity is to be considered as positive.

21. Quantities which have the same sign, either + or —, are said to have like signs. Thus, $+a$ and $+b$ have like signs, but $+a$ and $-c$ have unlike signs.

22. A quantity which consists of one *term*, is said to be *simple*; but if it consists of several terms, connected by the signs + or —, it is then said to be compound. Thus $+a$ and $-c$ are simple quantities; and $b+c$, also $a+b-d$, are compound quantities.

23. To denote the product arising from the multiplication of quantities; if they be simple, they are either joined together, as if intended to form a word, or else the quantities are connected together, with the sign \times interposed between every two of them. Thus ab , or $a \times b$, denotes the product of a and b ; also abc , or $a \times b \times c$ denotes the product of a , b , and c ; the latter method is used when the quantities to be multiplied are numbers. If some of the quantities to be multiplied be compound, each of them has a line drawn over it called a *vinculum*, and the sign \times is interposed between as before. Thus $a \times c + d \times e - f$ denotes that a is to be considered as one quantity, the sum of c and d as a second, and the difference between e and f as a third; and that these three quantities are to be multiplied into one another. Instead of placing a line over such compound quantities as enter a product, it is now common among mathematical writers to enclose each of them between two parentheses, so that the last product may be otherwise expressed thus, $a(c+d)(e-f)$, or thus, $a \times (c+d) \times (e-f)$.

24. A number prefixed to a letter is called a *numerical coefficient*, and denotes how often that quantity is to be taken. Thus, $3a$ signifies that a is to be taken three times. When no number is prefixed, the coefficient is understood to be unity.

25. The quotient arising from the division of one quantity by another is expressed by placing the *dividend*

above a line, and the *divisor* below it. Thus $\frac{12}{3}$ denotes the quotient arising from the division of 12 by 3, or 4 ; $\frac{b}{a}$ denotes the quotient arising from the division

of b by a . This expression of a quotient is also called *Addition* a fraction.

26. The equality of two quantities is expressed by putting the sign = between them. Thus $a+b=c-d$ denotes that the sum of a and b is equal to the excess of c above d .

27. Simple quantities, or the terms of compound quantities, are said to be *like*, which consist of the same letter or letters. Thus $+ab$ and $-5ab$ are like quantities; but $+ab$ and $+abb$ are unlike.

There are some other characters which will be explained when we have occasion to use them; and in what follows we shall suppose that the operations of common arithmetic are sufficiently understood; for algebra, being an extension of that science, ought not to be embarrassed by the demonstration of its elementary rules.

SECT. I. Fundamental Operations.

28. THE primary operations in algebra are the same as in common arithmetic, namely, addition, subtraction, multiplication, and division; and from the various combinations of these four, all the others are derived.

PROBLEM I. To Add Quantities.

29. In addition there may be three cases: the quantities to be added may be like, and have like signs; or, they may be like, and have unlike signs; or, lastly, they may be unlike.

Case 1. To add quantities which are like, and have like signs.

Rule. Add together the coefficients of the quantities, prefix the common sign to the sum, and annex the letter, or letters, common to each term.

EXAMPLES.

Add together	$\begin{array}{r} + 7a \\ + 3a \\ + a \\ + 2a \\ \hline \end{array}$	Add together	$\begin{array}{r} - 2ax \\ - ax \\ - 5ax \\ - 12ax \\ \hline \end{array}$
Sum,	+13a	Sum,	-20ax

Case 2. To add quantities which are like, but have unlike signs.

Rule. Add the positive coefficients into one sum, and the negative ones into another; then subtract the least of these sums from the greatest, prefix the sign of the greatest to the remainder, and annex the common letter, or letters, as before.

EXAMPLES.

Add together	$\begin{array}{r} + 2ax \\ - ax \\ - 3ax \\ + 9ax \\ \hline \end{array}$	Add together	$\begin{array}{r} + 6ab + 7 \\ - 4ab + 9 \\ + ab - 5 \\ + 7ab - 13 \\ \hline \end{array}$
Sum of the pos.	+11ax	Sum of the pos.	+14ab + 16
Sum of the neg.	- 4ax	Sum of the neg.	- 4ab - 18
Sum required,	+ 7ax	Sum required,	+ 10ab - 2

Subtraction.

$$\begin{array}{r} aa+2ax-xx \\ -2aa+3ax-4xx \\ \hline 6aa-5ax+11xx \end{array}$$

$$\begin{array}{r} -4aab \\ +aab \\ +3aab \end{array}$$

$$\begin{array}{r} -2ab \\ -3cx \\ \hline +6abcx \end{array}$$

Multiplication.

$$\text{Sum, } 5aa \text{ } 0 \text{ } + 6xx \quad \text{Sum, } 0$$

Case 3. To add unlike quantities.

Rule. Put down the quantities, one after another, in any order, with their signs and coefficients prefixed.

EXAMPLES.

$$\begin{array}{r} 2a \\ 3b \\ -4c \\ \hline \text{Sum, } 2a+3b-4c \end{array} \quad \begin{array}{r} ax+2ay \\ bb-3bx \\ \hline \text{Sum, } ax+2ay+bb-3bx \end{array}$$

PROB. II. To Subtract Quantities.

30. *General Rule.* Change the signs of the quantities to be subtracted, or suppose them changed, and then add them to the other quantities, agreeably to the rules of addition.

EXAMPLES.

$$\begin{array}{r} \text{From } 5a-12b \\ \text{Subtract } 2a-5b \\ \hline \text{Remainder } 3a-7b \end{array} \quad \begin{array}{r} \text{From } 6x-8y+3 \\ \text{Subtract } 2x+9y-2 \\ \hline \text{Remainder } 4x-17y+5 \end{array}$$

$$\begin{array}{r} 5xy-2+8x-y \\ 3xy-8-8x-3y \\ \hline 2xy+6+16x+2y \end{array} \quad \begin{array}{r} aa-ax-yy \\ bb-by+zx \\ \hline aa-ax-yy-bb+by-zx \end{array}$$

31. The reason of the rule for subtraction may be explained thus. Let it be required to subtract $2p-3q$ from $m+n$. If we subtract $2p$ from $m+n$ there will remain $m+n-2p$; but if we are to subtract $2p-3q$, which is less than $2p$, it is evident that the remainder will be greater by a quantity equal to $3q$; that is, the remainder will be $m+n-2p+3q$; hence the reason of the rule is evident.

PROB. III. To Multiply Quantities.

32. *General Rule for the Signs.* If the quantities to be multiplied have like signs, the sign of the product is +; but if they have unlike signs, the sign of the product is -.

33. The examples of multiplication may be referred to two cases; the first is when both the quantities are simple; and the second when one or both of them are compound.

Case 1. To multiply simple quantities.

Rule. Find the sign of the product by the general rule, and annex to it the product of the numeral coefficients; then set down all the letters, one after another, as in one word.

EXAMPLES.

$$\begin{array}{r} \text{Multiply } +a \\ \text{By } +c \\ \hline \text{Product } +ac \end{array} \quad \begin{array}{r} +5b \\ -4a \\ \hline -20ab \end{array} \quad \begin{array}{r} -3ax \\ +7ab \\ \hline -21aabcx \end{array}$$

Case 2. To multiply compound quantities.

Rule. Multiply every term of the multiplicand by all the terms of the multiplier, one after another, by the preceding rule, and collect their products into one sum, which will be the product required.

EXAMPLES.

$$\begin{array}{r} \text{Multiply } 4a-2b+c \\ \text{By } 3a \\ \hline \text{Product } 12aa-6ab+3ac \end{array} \quad \begin{array}{r} 2x+y \\ x-2y \\ \hline 2xx+xy \\ -4xy-2yy \\ \hline 2xx-3xy-2yy \end{array}$$

$$\begin{array}{r} aa-ab+bb \\ a+b \\ \hline aaa-aab+abb \\ +aab-abb+bbb \\ \hline aaa \quad * \quad *+bbb \end{array} \quad \begin{array}{r} a-b+c \\ a+b-c \\ \hline aa-ab+ac \\ +ab-bb+bc \\ -ac+bc-cc \\ \hline aa \quad * \quad *-bb+2bc-cc \end{array}$$

34. The reason of the rules for the multiplication of quantities may be explained in the following manner: Let it be required to multiply $a-b$ by $c-d$; because multiplication is a repeated addition of the multiplicand as often as the multiplier contains unity, therefore, $a-b$ is to be taken as often as there are units in $c-d$, and the sum will be the product required. Now if $a-b$ be taken as often as there are units in c , the result will evidently exceed the product required, and that by a quantity equal to $a-b$, taken as often as there are units in d . But, from the nature of addition $a-b$ taken as often as there are units in c , is $ca-cb$, and for the same reason, $a-b$ taken as often as there are units in d is $da-db$; therefore, to obtain the product required, we must subtract $da-db$ from $ca-cb$. but from what has been shewn in subtraction, the remainder will be $ca-cb-da+db$; therefore the product arising from the multiplication of $a-b$ by $c-d$ is $ca-cb-da+db$; hence the reason of the general rule for the signs as well as the other rules, is manifest.

35. When several quantities are multiplied together so as to constitute a product, each of them is called a *factor* of that product; thus a , b , and c are factors of the product abc ; also $a+x$, and $b-x$, are factors of the product $(a+x)(b-x)$.

36. The products arising from the continual multiplication of the same quantity are called *powers* of that quantity, which is called the *root*. Thus aa , aaa , $aaaa$, &c. are powers of the root a . These powers are commonly expressed, by placing above the root, towards the right hand, a figure, denoting how often the root is repeated. This figure serves to denominate the power, and is called its *index* or *exponent*. Thus, the quantity a being considered as the root, or as the first power of a , we have aa or a^2 for its second power,

Division. power, aaa or a^3 for its third power, $aaaa$ or a^4 for its fourth power, and so on.

37. The second and third powers of a quantity are generally called its *square* and *cube*; and the fourth, fifth, and sixth powers are sometimes respectively called its *biquadrate*, *sursolid*, and *cubocube*.

38. By considering the notation of powers, and the rules for multiplication, it appears that powers of the same root are multiplied by adding their exponents. Thus $a \times a^3 = a^4$, also $x^3 \times x^4 = x^7$; and in general $a^m \times a^n = a^{m+n}$.

PROB. IV. To Divide Quantities.

39. *General Rule for the Signs.*—If the signs of the divisor and dividend be like, the sign of the quotient is +; but if they be unlike, the sign of the quotient is —.

This rule is easily derived from the general rule for the signs in multiplication, by considering that the quotient must be such a quantity as when multiplied by the divisor shall produce the dividend, with its proper sign.

40. The quotient arising from the division of one quantity by another may be expressed by placing the dividend above a line and the divisor below it, (§ 25.); but it may also be often expressed in a more simple manner by the following rules:

Case. 1. When the divisor is simple, and a factor of every term of the dividend.

Rule. Divide the coefficient of each term of the dividend by the coefficient of the divisor, and expunge out of each term the letter or letters in the divisor: the result is the quotient.

Ex. 1. Divide $12abc$ by $3ac$.

From the method of notation, the quotient may be expressed thus, $\frac{12abc}{3ac}$; but the same quotient, by the rule just given, is more simply expressed thus, $4b$.

Ex. 2. Divide $16a^3xy - 28a^2xz^2 + 4a^3x^3$ by $4a^2x$.

The quotient is $4ay - 7xz^2 + x^3$.

If the divisor and dividend be powers of the same quantity, the division will evidently be performed by subtracting the exponent of the divisor from that of the dividend. Thus a^5 , divided by a^3 , has for a quotient $a^5 - a^3 = a^2$.

Case. 2. When the divisor is simple, but not a factor of the dividend.

Rule. The quotient is expressed by a fraction, of which the numerator is the dividend, and the denominator the divisor.

Thus the quotient of $3ab^3$, divided by $2mcd$, is the fraction $\frac{3ab^3}{2mcd}$.

It will sometimes happen, that the quotient found thus may be reduced to a more simple form, as shall be explained when we come to treat of fractions.

Case 3. When the divisor is compound.

Rule. 1. The terms of the dividend are to be arranged according to the powers of some one of its letters, and

those of the divisor according to the powers of the same letter. *Division.*

2. The first term of the dividend is to be divided by the first term of the divisor, observing the general rule for the signs; and this quotient being set down for a part of the quotient wanted, is to be multiplied by the whole divisor, and the product subtracted from the dividend. If nothing remain, the division is finished; but if there be a remainder, it is to be taken for a new dividend.
3. The first term of the new dividend is next to be divided by the first term of the divisor, as before, and the quotient joined to the part already found, with its proper sign. The whole divisor is also to be multiplied by this part of the quotient, and the product subtracted from the new dividend; and thus the operation is to be carried on till there be no remainder, or till it appear that there will always be a remainder.

To illustrate this rule, let it be required to divide $8a^2 + 2ab - 15b^3$ by $2a + 3b$, the operation will stand thus:

$$\begin{array}{r} 2a+3b \overline{) 8a^2+2ab-15b^3} \\ \underline{8a^2+12ab} \\ -10ab-15b^3 \\ \underline{-10ab-15b^3} \\ 0 \end{array}$$

Here the terms of the divisor and dividend are arranged according to the powers of the quantity a . We now divide $8a^2$, the first term of the dividend, by $2a$ the first term of the divisor; and thus get $4a$ for the first term of the quotient. We next multiply the divisor by $4a$, and subtract the product $8a^2 + 12ab$ from the dividend; we thus get $-10ab - 15b^3$ for a new dividend.

By proceeding in all respects as before, we find $-5b$ for the second term of the quotient, and no remainder; the operation is therefore finished, and the whole quotient is $4a - 5b$.

The following examples will also serve to illustrate the manner of applying the rule.

Ex. 1.

$$\begin{array}{r} 3a-b \overline{) 3a^3-12a^2-a^2b+10ab-2b^3} \\ \underline{3a^3-12a^2} \\ 0 +10ab-2b^3 \\ \underline{0+10ab-12ab} \\ 2ab-2b^3 \\ \underline{2ab-2b^3} \\ 0 \end{array}$$

Ex. 2.

$$\begin{array}{r} a+b \overline{) a^3+b^3(a^2-ab+b^2)} \\ \underline{a^3+a^2b} \\ 0 +b^3(a^2-ab+b^2) \\ \underline{0+a^2b+b^3} \\ 0 -ab^3+b^3 \\ \underline{0-ab^3+b^3} \\ 0 \end{array}$$

Ex. 3.

Fractions.

$$\begin{array}{r} \text{Ex. 3.} \\ a^3 - b^3 \overline{) a^6 - b^6} \end{array}$$

$$\begin{array}{r} + a^3 b^3 - b^6 \\ + a^3 b^3 - b^6 \\ \hline \end{array}$$

$$\begin{array}{r} \text{Ex. 4.} \\ 1-x \overline{) 1+x+x^2+\dots} \end{array}$$

$$\begin{array}{r} +x \\ +x-x^2 \\ \hline +x^2 \\ +x^2-x^3 \\ \hline +x^3 \end{array}$$

41. Sometimes, as in this last example, the quotient will never terminate: in such a case it may either be considered as an infinite series, the law according to which the terms are formed being in general sufficiently obvious; or the quotient may be completed as in arithmetical division, by annexing to it a fraction, the numerator of which is the remainder, and denominator the divisor. Thus the quotient in last example may stand thus $1+x+x^2+\frac{x^3}{1-x}$.

42. The reason of the rule for division is sufficiently manifest. For in the course of the operation, all the terms of the quotient obtained by it are multiplied by all the terms of the divisor, and the products successively subtracted from the dividend, till nothing remain; that therefore must evidently be the true quotient.

SECT. II. Of Fractions.

43. In the operation of division, the divisor may be sometimes less than the dividend, or may not be contained in it an exact number of times; in either case the quotient is expressed by means of a fraction. There can be no difficulty, however, in estimating the magnitude of such a quotient; if, for example, it were the fraction $\frac{7}{5}$, we may consider it as denoting either that some unit is divided into 7 equal parts, and that 5 of these are taken, or that 5 times the same unit is divided into seven equal parts, and one of them taken.

44. In any fraction the upper number, or the dividend, is called the *numerator*, and the lower number or the divisor is called the *denominator*. Thus in the fraction $\frac{a}{b}$, a is the numerator, and b the denominator.

45. If the numerator be less than the denominator, such a fraction is called a *proper* fraction; but if the numerator be either equal to, or greater than the denominator, it is called an *improper* fraction; and if a quantity be made up of an integer and a fraction, it is called a *mixed* quantity. Thus $\frac{a}{a+x}$ is a proper fraction;

$\frac{a}{a}$, also $\frac{a+x}{a}$, are both improper fractions; and $b+\frac{x}{a}$ is a mixed quantity.

46. The *reciprocal* of a fraction is another fraction, having its numerator and denominator respectively equal to the denominator and numerator of the former.

Thus $\frac{b}{a}$ is the reciprocal of the fraction $\frac{a}{b}$.

47. The following proposition is of great importance in the operations relating to fractions.

If the numerator and denominator of a fraction be either both multiplied, or both divided, by the same quantity, the value of that fraction is the same as before.

For let any fraction $\frac{b}{a}=c$; then because c is the quotient arising from the division of b by a , it follows that $b=ac$; and multiplying both by any quantity n , we have $nb=nac$: let these equals be both divided by the same quantity na , and the quotients will be equal, that is $\frac{nb}{na}=c=\frac{b}{a}$; hence the truth of the proposition is manifest.

48. From this proposition, it is obvious that a fraction may be very differently expressed, without changing its value, and that any integer may be reduced to the form of a fraction, by placing the product arising from its multiplication by any assumed quantity as the numerator, and the assumed quantity as the denominator of the fraction. It also appears that a fraction very complex in its form may often be reduced to another of the same value, but more simple, by finding a quantity which will divide both the numerator and denominator, without leaving a remainder. Such a common measure, or common divisor, may be either simple or compound; if it be simple it is readily found by inspection, but if it be compound, it may be found as in the following problem.

49. PROB. I. To find the greatest common Measure of two Quantities.

Rule. 1. Range the quantities according to the power of some one of the letters, as taught in division, leaving out the simple divisors of each quantity.

2. Divide that quantity which is of most dimensions by the other one, and if there be a remainder, divide it by its greatest simple divisor; and then divide the last compound divisor by the resulting quantity, and if any thing yet remain, divide it also by its greatest simple divisor, and the last compound divisor by the resulting quantity; proceed in this way till nothing remain, and the last divisor shall be the common measure required.

Note. It will sometimes be necessary to multiply the dividends by simple quantities in order to make the divisions succeed.

Ex. 1. Required the greatest common measure of the quantities a^2x-x^3 and $a^3-2a^2x+ax^2$. The simple divisor x being taken out of the former of these quantities, and a out of the latter, they are reduced to a^2-x^2 , and $a^2-2ax+x^2$ and as the quantity a rises to the same dimensions in both, we may take either of them as the first divisor; let us take that which consists of fewest terms, and the operation will stand thus:

$$a^2-x^2$$

ctions.

$$\begin{array}{r} a^2 - x^2 \\ a^2 - x^2 \end{array}$$

which divided by $-2x$ is $a-x$ remainder, $a^2 - x^2$

$$\begin{array}{r} -2ax + x^2 \text{ remainder,} \\ a^2 - x^2 \\ \hline +ax - x^2 \\ +ax - x^2 \\ \hline * * \end{array}$$

Hence it appears that $a-x$ is the greatest common measure required.

Ex. 2. Required the greatest common measure of $8a^2b^2 - 10ab^3 + 2b^4$, and $9a^4b - 9a^2b^2 + 3a^2b^3 - 3ab^4$.

It is evident, from inspection, that b is a simple divisor of both quantities; it will therefore be a factor of the common measure required. Let the simple divisors be now left out of each quantity, and they are reduced to $4a^2 - 5ab + b^2$ and $3a^3 - 3a^2b + ab^2 - b^3$; but as the second of these is to be divided by the first, it must be multiplied by 4 to make the division succeed, and the operation will stand thus:

$$\begin{array}{r} 4a^2 - 5ab + b^2 \quad 12a^3 - 12a^2b + 4ab^2 - 4b^3 \quad (3a \\ 12a^3 - 15a^2b + 3ab^2 \\ \hline + 3a^2b + ab^3 + 4b^3. \end{array}$$

This remainder is to be divided by b , and the new dividend multiplied by 3, to make the division again succeed, and the work will stand thus:

$$\begin{array}{r} 3a^2 + ab - 4b^2 \quad 12a^3 - 15ab + 3b^2 \quad (4 \\ 12a^3 + 4ab - 16b^2 \\ \hline -19ab + 19b^2. \end{array}$$

This remainder is to be divided by $-19b$, which being done, and the last divisor taken as a dividend as before, the rest of the operation will be as follows:

$$\begin{array}{r} a-b \quad 3a^2 + ab - 4b^2 \quad (3a + 4b \\ 3a^2 - 3ab \\ \hline +4ab - 4b^2 \\ +4ab - 4b^2 \\ \hline * * \end{array}$$

from which it appears that the compound divisor sought is $a-b$, and remarking that the quantities proposed have also a simple divisor b , the greatest common measure which is required will be $b(a-b)$.

50. The reason of the rule given in this problem may be deduced from the following considerations.

1. If two quantities have a compound divisor common to both, and they be either multiplied or divided by any simple quantities, the results will each have the same compound divisor. Thus the quantities, $p(a-x)$ and $q(a-x)$ have the common divisor $a-x$, and the quantities $np(a-x)$, $r q(a-x)$ have each the very same divisor.

2. In the operation of division, whatever quantity measures both the divisor and dividend, the same will also measure the remainder. For let x be such a quantity, then the divisor and dividend may be represented

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by ax and bx ; let q be the quotient, and the remainder rx , will evidently be $bx - qax$, which is evidently divisible by x .

3. Whatever quantity measures both the divisor and remainder, the same will also measure the dividend.

For let the divisor be ax , and the remainder rx , then, q denoting the quotient, the dividend will be $aqx + rx$, which, as well as the divisor and dividend, is divisible by x .

51. Let us apply these observations to the last example. From the first observation, the reason for leaving out the simple quantities in the course of the operation, as well as for multiplying by certain other quantities, to make the divisions succeed, is obvious; and from the second observation it appears, that whatever quantity measures $4a^2 - 5ab + b^2$, and $12a^3 - 12a^2b + 4ab^2 - 4b^3$, the same must measure $3a^2b + ab^3 - 4b^3$, the first remainder, as also $-19ab + 19ab^2$, the second remainder; but the only compound divisor which this last quantity can have is $a-b$, which is also found to be a divisor of $3a^2 + ab - 4b^2$, or of $3a^2b + ab^3 - 4b^3$ the first remainder, therefore, by the third observation, $a-b$ must also be a divisor of $12a^3 - 12a^2b + 4ab^2 - 4b^3$ the first dividend, so that $a-b$ is the greatest common measure, as was required.

52. PROB. II. To Reduce a Fraction to its lowest Terms.

Rule. Divide both numerator and denominator by their greatest common measure, which may be found by prob. I.

Ex. 1. Reduce $\frac{56a^2bc}{24adc^2}$ to its lowest terms.

It appears from inspection, that the greatest common measure is $8ac$, and dividing both numerator and denominator by this quantity, we have $\frac{56a^2bc}{24adc^2} = \frac{7ab}{3dc}$.

Ex. 2. Reduce $\frac{a^2x - x^3}{a^3 - 2a^2x + ax^2}$ to its lowest terms.

We have already found in the first example of prob. I. that the greatest common measure of the numerator and denominator is $a-x$; and dividing both by this quantity we have

$$\frac{a^2x - x^3}{a^3 - 2a^2x + ax^2} = \frac{ax + x^2}{a^2 - ax}$$

In like manner we find $\frac{9a^4b - 9a^3b^2 + 3a^2b^3 - 3ab^4}{8a^2b^2 - 10ab^3 + 2b^4} = \frac{9a^3 + 3ab^2}{8ab - 2b^3}$; the common measure being $b(a-b)$ as was shown in example 2. problem I.

53. PROB. III. To Reduce a mixed Quantity to an improper Fraction.

Rule. Multiply the integer by the denominator of the fraction, and to the product add the numerator; and the denominator being placed under this sum will give the improper fraction required.

4 H

Ex. 1.

Fractions.

Ex. 1. Let $x + \frac{x^2}{a}$, and $x - \frac{a^2 - x^2}{x}$ be reduced to improper fractions.

First $x + \frac{x^2}{a} = \frac{ax + x^2}{a}$, the answer.

And $x - \frac{a^2 - x^2}{x} = \frac{x^2 - a^2 + x^2}{x} = \frac{2x^2 - a^2}{x}$, Ans.

Ex. 2. Reduce $a - x + \frac{x^2}{a+x}$ to an improper fraction.

$a - x + \frac{x^2}{a+x} = \frac{(a+x)(a-x) + x^2}{a+x} = \frac{a^2}{a+x}$, Ans.

54. PROB. IV. To Reduce an improper Fraction to a whole or mixed number.

Rule. Divide the numerator by the denominator for the integral part, and place the remainder, if any, over the denominator, and it will be the mixed quantity required.

Ex. 1. Reduce $\frac{ax + a^2}{x}$ to a whole or mixed quantity.

$\frac{ax + a^2}{x} = a + \frac{a^2}{x}$ the answer required.

Ex. 2. Reduce $\frac{ax + 2x^2}{a+x}$, also $\frac{x^2 - y^2}{x-y}$, to whole or mixed quantities.

First $\frac{ax + 2x^2}{a+x} = x + \frac{x^2}{a+x}$ the answer.

And $\frac{x^2 - y^2}{x-y} = x + y$ a whole quantity, which is the answer.

55. PROB. V. To Reduce Fractions of different Denominators to others of the same value which shall have a common Denominator.

Rule. Multiply each numerator separately into all the denominators except its own for the new numerators, and all the denominators together for the common denominator.

Ex. 1. Reduce $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$ to fractions of equal value which have a common denominator.

$\left. \begin{array}{l} a \times d \times f = adf \\ c \times b \times f = cbf \\ e \times b \times d = ebd \end{array} \right\}$ New numerators.

$b \times d \times f = bdf$ Common denominator.

Hence we find $\frac{a}{b} = \frac{adf}{bdf}$, $\frac{c}{d} = \frac{cbf}{bdf}$, and $\frac{e}{f} = \frac{ebd}{bdf}$, where the new fractions have a common denominator, as was required.

Ex. 2. Reduce $\frac{ax}{a-x}$ and $\frac{a^2 - x^2}{a+x}$ to fractions of equal value and having a common denominator.

$\left. \begin{array}{l} ax(a+x) = a^2x + ax^2 \\ (a^2 - x^2)(a-x) = a^3 - a^2x - ax^2 + x^3 \end{array} \right\}$ new numerators. Fractions.

$(a-x)(a+x) = a^2 - x^2$ the common denominator.

Hence $\frac{ax}{a-x} = \frac{a^2x + ax^2}{a^2 - x^2}$ and $\frac{a^2 - x^2}{a+x} = \frac{a^3 - a^2x - ax^2 + x^3}{a^2 - x^2}$

56. PROB. VI. To Add or Subtract Fractions.

Rule. Reduce the fractions to a common denominator, and add or subtract their numerators, and the sum or difference placed over the common denominator, is the sum or remainder required.

Ex. 1. Add together $\frac{a}{b}$, $\frac{c}{d}$ and $\frac{e}{f}$

$\frac{a}{b} = \frac{adf}{bdf}$

$\frac{c}{d} = \frac{bcf}{bdf}$

$\frac{e}{f} = \frac{bde}{bdf}$

Hence $\frac{a}{b} + \frac{c}{d} + \frac{e}{f} = \frac{adf + bcf + bde}{bdf}$ the sum required.

Ex. 2. From $\frac{a+x}{a}$ subtract $\frac{a}{a+x}$.

$\frac{a+x}{a} = \frac{a^2 + 2ax + x^2}{a^2 + ax}$

$\frac{a}{a+x} = \frac{a^2}{a^2 + ax}$

Hence $\frac{a+x}{a} - \frac{a}{a+x} = \frac{2ax + x^2}{a^2 + ax}$.

Ex. 3. Add together $\frac{x+2}{3}$, $\frac{x}{4}$ and $\frac{x-5}{2}$.

$\frac{x+2}{3} + \frac{x}{4} + \frac{x-5}{2} = \frac{8x + 16 + 6x + 12x - 60}{24} = \frac{13x - 22}{24}$.

If it be required to add or subtract mixed quantities, they may either be reduced to the form of fractions by prob. 3. and then added or subtracted, or else these operations may be performed first on the integer quantities, and afterwards on the fractions.

57. PROB. VII. To Multiply Fractions.

Rule. Multiply the numerators of the fractions for the numerator of the product, and the denominators for the denominator of the product.

Ex. 1. Multiply $\frac{b}{a}$ by $\frac{d}{c}$

$\frac{b}{a} \times \frac{d}{c} = \frac{bd}{ac}$ the product required.

Ex. 2. Multiply $\frac{a+b}{c}$ by $\frac{a-b}{d}$.

$\frac{a+b}{c} \times \frac{a-b}{d} = \frac{a^2 - b^2}{cd}$ the product.

If it be required to multiply an integer by a fraction, the integer may be considered as having unity for a denominator. Thus $(a+x) + \frac{3d}{c} = \frac{a+x}{1} \times \frac{3d}{c} = \frac{3ad + 3dx}{c}$.

Mixed

ctions. Mixed quantities may be multiplied after being reduced to the form of fractions by prob. 3. Thus

$$\left(b + \frac{bx}{a}\right) \times \frac{a}{x} = \frac{ab + bx}{a} \times \frac{a}{x} = \frac{a^2b + abx}{ax} = \frac{ab + bx}{x}.$$

58. The reason of the rule for multiplication may be explained thus. If $\frac{a}{b}$ is to be multiplied by c , the product will evidently be $\frac{ac}{b}$; but if it is only to be multiplied by $\frac{c}{d}$, the former product must be divided by d , and it becomes $\frac{ac}{bd}$, which is the product required.

Or let $\frac{a}{b} = m$, and $\frac{c}{d} = n$, then $a = bm$ and $c = dn$ and $ac = bdmn$; hence mn or $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$.

59. PROB. VIII. To Divide Fractions.

Rule. Multiply the denominator of the divisor by the numerator of the dividend for the numerator of the quotient. Then multiply the numerator of the divisor by the denominator of the dividend for the denominator of the quotient.

Or, multiply the dividend by the reciprocal of the divisor, the product will be the quotient required.

Ex. 1. Divide $\frac{a}{b}$ by $\frac{c}{d}$.

$\frac{c}{d} \frac{a}{b} \frac{ad}{bc}$ the quotient required, or $\frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$ as before.

Ex. 2. Divide $\frac{a^2 + ab}{2x}$ by $\frac{3a}{a-b}$.

$$\frac{3a^2}{a-b} \frac{a^2 + ab}{2x} \left(\frac{a^3 - ab^2}{6a^2x} = \frac{a^2 - b}{6ax} \right) \text{ the quotient.}$$

If either the divisor or dividend be an integer quantity, it may be represented as a fraction, by placing unity for a denominator; or if it be a mixed quantity, it may be reduced to a fraction by prob. 3. and the operation of division performed agreeably to the rule.

60. The reason of the rule for division may be explained thus: let it be required to divide $\frac{c}{d}$ by $\frac{a}{b}$. If $\frac{c}{d}$ is to be divided by a , the quotient is $\frac{c}{ad}$, but if it

is to be divided by $\frac{a}{b}$, then the last quotient must be multiplied by b ; thus we have $\frac{cb}{ad}$ for the quotient required.

Or let $\frac{a}{b} = m$, and $\frac{c}{d} = n$, then $a = bm$ and $c = dn$; also $ad = bdm$ and $bc = bdn$; therefore $\frac{bdn}{bdm} =$

$$\frac{n}{m} = \frac{bc}{ad}.$$

SECT. III. Of Involution and Evolution.

Involution
and
Evolution.

61. IN treating of multiplication, we have observed, that when a quantity is multiplied by itself any number of times, the product is called a *power* of that quantity, while the quantity itself, from which the powers are formed, is called the *root* (§ 36.) Thus a , a^2 , and a^3 are the first, second, and third powers of the root a ; and in like manner $\frac{1}{a}$, $\frac{1}{a^2}$, and $\frac{1}{a^3}$, denote the same powers of the root $\frac{1}{a}$.

62. But before considering more particularly what relates to powers and roots, it will be proper to observe, that the quantities $\frac{1}{a}$, $\frac{1}{a^2}$, $\frac{1}{a^3}$, &c. admit of being expressed under a different form; for, like as the quantities a , a^2 , a^3 , &c. are expressed as *positive* powers of the root a , so the quantities $\frac{1}{a}$, $\frac{1}{a^2}$, $\frac{1}{a^3}$, &c. may be respectively expressed thus, a^{-1} , a^{-2} , a^{-3} , &c. and considered as *negative* powers of the root a .

63. This method of expressing the fractions $\frac{1}{a}$, $\frac{1}{a^2}$, $\frac{1}{a^3}$, as powers of the root a , but with negative indices, is a consequence of the rule which has been given for the division of powers; for we may consider $\frac{1}{a}$ as the quotient arising from the division of any power of a by the next higher power, for example from the division of the 2d by the 3d, and so we have $\frac{1}{a} = \frac{a^2}{a^3}$; but since powers of the same quantity are divided by subtracting the exponent of the divisor from that of the dividend (§ 40.), it follows, that $\frac{a^2}{a^3} = a^{2-3} = a^{-1}$; therefore the

fraction $\frac{1}{a}$ may also be expressed thus, a^{-1} . By considering $\frac{1}{a}$ as equal to $\frac{a^2}{a^4}$, it will appear in the same manner that $\frac{1}{a^2} = \frac{a^2}{a^4} = a^{-2}$; and proceeding in this way, we get $\frac{1}{a^3} = \frac{a^2}{a^5} = a^{-3}$, $\frac{1}{a^4} = \frac{a^2}{a^6} = a^{-4}$, &c. and so on, as far as we please. It also appears, that unity or 1 may be represented by a^0 , where the exponent is a cypher, for $1 = \frac{a^2}{a^2} = a^{2-2} = a^0$.

64. The rules which have been given for the multiplication and division of powers with positive exponents will apply in every case, whether the exponents be positive or negative; and this must evidently take place, for the mode of notation, by which we represent fractional quantities as the powers of integers, but with negative exponents, has been derived from those rules.

Thus $\frac{1}{a^2} \times a^3$ or $a^{-2} \times a^3 = a^{-2+3} = a^{-1} = \frac{1}{a}$, also $\frac{1}{x^2} \times$

Involution. $\frac{1}{x^3}$ or $x^{-3} \times x^{-3} = x^{-3-3} = x^{-6} = \frac{1}{x^6}$ and $\frac{1}{x^2} \times x^3$ or $x^{-2} \times x^3 = x^{-2+3} = x^1 = x$.

65. From this method of notation it appears, that any quantity may be taken from the denominator of a fraction, and placed in the numerator, by changing the sign of its exponent; and hence it follows, that every fraction may also be represented as an integer quantity. Thus $\frac{a^2}{bc^3}$ denotes the same thing as $\frac{a^2b^{-1}}{c^3}$ or as $a^2b^{-1}c^{-3}$, also $\frac{a^2}{(x-1)^3}$ may be otherwise expressed thus, $a^2(x-1)^{-3}$.

Of Involution.

66. Involution is the method of finding any power of any assigned quantity, whether it be simple or compound; hence its rules are easily derived from the operation of multiplication.

Case 1. When the quantity is simple.

Rule. Multiply the exponents of the letters by the index of the power required, and raise the coefficient to the same power.

Note. If the sign of the quantity be +, all its powers will be positive; but if it be -, then all its powers, whose exponents are even numbers, are positive, and all its powers whose exponents are odd numbers are negative.

Ex. 1. Required the cube, or third power of $2a^2x$. $(2a^2x)^3 = 2 \times 2 \times 2a^2 \times x^3 = 8a^6x^3$, the answer.

Ex. 2. Required the fifth power of $-3a^3x^3$. $(-3a^3x^3)^5 = -243a^{15}x^{15}$, the answer.

Ex. 3. Required the fourth power of $-\frac{2ax^2}{3b^2y}$. $\left(-\frac{2ax^2}{3b^2y}\right)^4 = \frac{16a^4x^8}{81b^8y^4}$ the answer.

Case 2. When the quantity is compound.

Rule. The powers must be found by a continual multiplication of the quantity by itself.

Ex. Required the first four powers of the binomial quantity $a+x$.

$a+x$ the root, or first power

$$\begin{array}{r} a+x \\ \hline a^2+ax \\ +ax+x^2 \end{array}$$

$a^2+2ax+x^2$ the square, or second power

$$\begin{array}{r} a^2+2ax+x^2 \\ \hline a^3+2a^2x+ax^2 \\ +a^2x+2ax^2+x^3 \end{array}$$

$a^3+3a^2x+3ax^2+x^3$ the cube, or third power

$$\begin{array}{r} a^3+3a^2x+3ax^2+x^3 \\ \hline a^4+4a^3x+6a^2x^2+3ax^3+x^4 \end{array}$$

$a^4+4a^3x+6a^2x^2+4ax^3+x^4$ the fourth power.

If it be required to find the same powers of $a-x$, it will be found, that

$a-x$ is the root or first power;
 $a^2-2ax+x^2$ the square, or 2d power;
 $a^3-3a^2x+3ax^2-x^3$ the cube, or 3d power;
 $a^4-4a^3x+6a^2x^2-4ax^3+x^4$ the 4th power.

Hence it appears, that the powers of $a+x$ differ from the powers of $a-x$, only in this respect, that in the former the signs of the terms are all positive, but in the latter, they are positive and negative alternately.

67. Besides the method of finding the powers of a compound quantity by multiplication, which we have just now explained, there is another, more general, as well as more expeditious, by which a quantity may be raised to any power whatever without the trouble of finding any of the inferior powers, namely, by means of what is commonly called the *binomial theorem*. This theorem may be expressed as follows. Let $a+x$ be a binomial quantity, which is to be raised to any power denoted by the number n , then $(a+x)^n = a^n +$

$\frac{n}{1}a^{n-1}x + \frac{n(n-1)}{1 \cdot 2}a^{n-2}x^2 + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3}a^{n-3}x^3 + \frac{n(n-1)(n-2)(n-3)}{1 \cdot 2 \cdot 3 \cdot 4}a^{n-4}x^4 + \frac{n(n-1)(n-2)(n-3)(n-4)}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5}a^{n-5}x^5 + \&c.$ This series will always terminate when n is any whole positive number, by reason of some one of the factors $n-1, n-2, \&c.$ becoming $= 0$; but if n be either a negative, or fractional number, the series will consist of an infinite number of terms; as, however, we mean to treat in this section only of the powers of quantities when their exponents are whole positive numbers, we shall make no farther remarks upon any other; we shall afterwards give a demonstration of the theorem, and shew its application to fractional and negative powers in treating of infinite series. The n th power of $a-x$ will not differ from the same power of $a+x$, but in the signs of the terms which compose it, for it will stand thus: $(a-x)^n = a^n - \frac{n}{1}a^{n-1}x + \frac{n(n-1)}{1 \cdot 2}a^{n-2}x^2 - \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3}a^{n-3}x^3 + \frac{n(n-1)(n-2)(n-3)}{1 \cdot 2 \cdot 3 \cdot 4}a^{n-4}x^4 - \&c.$ where the signs are + and - alternately.

Ex. 1. Let it be required to raise $a+x$ to the fifth power.

Here n the exponent of the power being 5, the first term a^n of the general theorem will be equal to a^5 , the second $na^{n-1}x = 5a^4x$, the third $\frac{n(n-1)}{1 \cdot 2}a^{n-2}x^2 = \frac{5 \times 4}{1 \times 2}a^3x^2 = 10a^3x^2$, the fourth $\frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3}a^{n-3}x^3 = \frac{5 \times 4 \times 3}{1 \times 2 \times 3}a^2x^3 = 10a^2x^3$, the fifth $\frac{n(n-1)(n-2)(n-3)}{1 \cdot 2 \cdot 3 \cdot 4}a^{n-4}x^4 = \frac{5 \times 4 \times 3 \times 2}{1 \times 2 \times 3 \times 4}a^1x^4 = 5ax^4$ and the sixth and last $\frac{n(n-1)(n-2)(n-3)(n-4)}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5}a^{n-5}x^5 = \frac{5 \times 4 \times 3 \times 2 \times 1}{1 \times 2 \times 3 \times 4 \times 5}a^0x^5 = x^5$; the remaining terms

of

olution. of the general theorem all vanish, by reason of the factor $n-5=0$ by which each of them is multiplied, so that we get $(a+x)^5 = a^5 + 5a^4x + 10a^3x^2 + 10a^2x^3 + 5ax^4 + x^5$.

Ex. 2. It is required to raise $2d - \frac{x}{3}$ to the third power.

In this case $n=3$, so that if we put $a=2d$ and $x=\frac{x}{3}$ we have the first term of the general theorem, or $a^n=8d^3$, the second $\frac{n}{1}a^{n-1}x=3 \times 4d^2 \times \frac{x}{3}=4d^2x$, the third $\frac{n(n-1)}{1 \cdot 2}a^{n-2}x^2=3 \times 2d \times \frac{x^2}{9}=\frac{2dx^2}{3}$, and the fourth and last term $\frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3}a^{n-3}x^3=\frac{x^3}{27}$, and since the signs of the terms of any power of $a-x$ are + and - alternately, we have $(2d - \frac{x}{3})^3 = 8d^3 - 4d^2x + \frac{2dx^2}{3} - \frac{x^3}{27}$.

68. If the quantity to be involved consists of more than two terms, as if $p+q-r$ were to be raised to the 2d power, put $p=a$ and $q-r=b$, then $(p+q-r)^2 = (a+b)^2 = a^2 + 2ab + b^2 = p^2 + 2p(q-r) + (q-r)^2$, but $2p(q-r) = 2pq - 2pr$, and by the general theorem $(q-r)^2 = q^2 - 2qr + r^2$, therefore, we get $(p+q-r)^2 = p^2 + 2pq - 2pr + q^2 - 2qr + r^2$; and by a similar method of procedure a quantity consisting of four or more terms may be raised to any power.

Of Evolution.

69. Evolution is the reverse of involution, or it is the method of finding the root of any quantity, whether simple or compound, which is considered as a power of the root; hence it follows that its operations, generally speaking, must be the reverse of those of involution.

70. To denote that the root of any quantity is to be taken, the sign $\sqrt{}$ (called the *radical sign*) is placed before it, and a small number placed over the sign to express the denomination of the root. Thus $\sqrt[2]{a}$ denotes the square root of a , $\sqrt[3]{a}$ its cube root, $\sqrt[4]{a}$ its fourth root, and in general, $\sqrt[n]{a}$ its n th root. The number placed over the radical sign is called the *index* or *exponent* of the root, and is usually omitted in expressing the square root, thus either \sqrt{a} or $\sqrt[2]{a}$ denotes the square root of a .

71. Case 1. When roots of simple quantities are to be found.

Rule. Divide the exponents of the letters by the index of the root required, and prefix the root of the numeral coefficient; the result will be the root required.

Note 1. The root of any positive quantity may be either positive or negative, if the index of the root be an

even number; but if it be an odd number, the root can be positive only.

2. The root of a negative quantity is also negative when the index of the root is an odd number.
3. But if the quantity be negative, and the index of the root even, then no root can be assigned.

Ex. 1. Required the square root of $36a^2x^4$.

Here the index of the root is 2, and the root of the coefficient 6, therefore $\sqrt{36a^2x^4} = \pm 6ax^2$ or $\sqrt{36a^2x^4} = -6ax^2$, for neither of these quantities, when multiplied by itself, produces $36a^2x^4$; so that the root required is $\pm 6ax^2$, where the sign \pm denotes that the quantity to which it is prefixed may be considered either as positive or negative.

Ex. 2. Required the cube root of $125a^6x^9$.

Here the index of the root is 3, and the root of the coefficient 5, therefore $\sqrt[3]{125a^6x^9} = 5a^2x^3$ the root required; and in like manner the cube root of $-125a^6x^9$ is found to be $-5a^2x^3$.

72. If it be required to extract the square of $-a^2$, it will immediately appear that no root can be assigned; for it can neither be $+a$, nor $-a$, seeing that each of these quantities, when squared, produces $+a^2$, the root required is therefore said to be *impossible*, and may be expressed thus: $\sqrt{-a^2}$.

The root of a fraction is found by extracting that root out of both numerator and denominator. Thus the

square root of $\frac{4a^2x^4}{9b^2y^6}$ is $\frac{2ax^2}{3by^3}$.

Case 2. When the quantity of which the root is to be extracted is compound.

73. I. To extract the square root.

Range the terms of the quantity according to the powers of the letters, as in division.

Find the square root of the first term for the first part of the root sought, subtract its square from the given quantity, and divide the remainder by double the part already found, and the quotient is the second term of the root.

Add the second part to double the first, and multiply their sum by the second part, subtract the product from the remainder, and if nothing remain, the square root is obtained. But if there is a remainder, it must be divided by the double of the parts already found, and the quotient will give the third term of the root, and so on.

Ex. 1. Required the square root of $a^2 + 2ax + x^2$.

$$\begin{array}{r} a^2 + 2ax + x^2 \text{ (the root required)} \\ \underline{a^2} \\ 2a + x \\ \underline{ + 2ax + x^2} \\ x \\ \underline{ + 2ax + x^2} \\ \end{array}$$

Ex. 2.

Evolution.

Ex. 2. Required the square root of $x^4 - 2x^3 + \frac{3}{2}x^2 -$

$$\frac{x}{2} + \frac{1}{16}$$

$$\begin{array}{r} x^4 - 2x^3 + \frac{3}{2}x^2 - \frac{x}{2} + \frac{1}{16} \left(x^2 - x + \frac{1}{4} \right. \\ \hline x^4 \\ \hline 2x^2 - x \left. \right) - 2x^3 + \frac{3}{2}x^2 \\ \hline x - x - 2x^3 + x^2 \\ \hline 2x^2 - 2x + \frac{1}{4} \left. \right) \frac{x^2}{2} - \frac{x}{2} + \frac{1}{16} \\ \hline x \times \frac{1}{4} \frac{x^2}{2} - \frac{x}{2} + \frac{1}{16} \\ \hline * * * \end{array}$$

74. To understand the reason of the rule for finding the square root of a compound quantity, it is only necessary to involve any quantity, as $a+b+c$ to the second power, and observe the composition of its square; for we have $(a+b+c)^2 = a^2 + 2ab + b^2 + 2ac + 2bc + c^2$; but $2ab + b^2 = (2a+b)b$ and $2ac + 2bc + c^2 = (2a+2b+c)c$, therefore,
 $(a+b+c)^2 = a^2 + (2a+b)b + (2a+2b+c)c$;
 and from this expression the manner of deriving the rule is obvious.

As an illustration of the common rule for extracting the square root of any proposed number, we shall suppose that the root of 59049 is required.

Accordingly we have $(a+b+c)^2 = 59049$, and from hence we are to find the values of a , b , and c .

$$\begin{array}{r} a^2 = 200 \times 200 = 40000 \quad 200 = a \\ \quad \quad \quad \quad \quad \quad \quad 40 = b \\ \quad \quad \quad \quad \quad \quad \quad 3 = c \end{array} \quad \text{Hence 243 is the root required.}$$

$$\begin{array}{r} 2a = 400 \quad 19049 \\ b = 40 \\ \hline 2a + b = 440 \quad 17600 = (2a+b)b \\ \hline 2a + 2b = 480 \quad 1449 \\ c = 3 \\ \hline 2a + 2b + c = 483 \quad 1449 = (2a+2b+c)c \end{array}$$

The same example when wrought by the common rule (see ARITHMETIC) will stand thus:

$$\begin{array}{r} 13312053 \quad 200 = a \\ = a^2 = 8000000 \quad 30 = b \\ \quad \quad \quad \quad \quad \quad \quad 7 = c \\ \hline 3a^2 = 120000 \quad 5312053 \\ 3ab = 18000 \\ b^2 = 900 \\ \hline 3a^2 + 3ab + b^2 = 138900 \quad 4167000 = (3a^2 + 3ab + b^2)b \\ \hline 3(a+b)^2 = 158700 \quad 1145053 \\ 3(a+b)c = 4830 \\ c^2 = 49 \\ \hline a(a+b)^2 + 3(a+b)c + c^2 = 163579 \quad 1145053 = [3(a+b)^2 + 3(a+b)c + c^2]c \end{array}$$

Evolution

59049 (243 the root required.)

$$\begin{array}{r} 4 \\ \hline 44) 190 \\ 176 \\ \hline 483) 1449 \\ 1449 \\ \hline \end{array}$$

and by a comparison of the two operations, the reason of the common rule is obvious.

75. II. To extract the cube root.

Range the terms of the quantity according to the powers of some one of the letters.

Find the root of the first term, for the first part of the root sought; subtract its cube from the whole quantity, and divide the remainder by 3 times the square of the part already found, and the quotient is the second part of the root.

Add together, 3 times the square of the part of the root already found, 3 times the product of that part and the second part of the root, and the square of the second part: multiply the sum by the second part, and subtract the product from the first remainder, and if nothing remain, the root is obtained; but if there is a remainder, it must be divided by 3 times the square of the sum of the parts already found, and the quotient is a third term of the root, and so on, till the whole root is obtained.

Ex. Required the cube root of $a^3 + 3a^2x + 3ax^2 + x^3$.

$a^3 + 3a^2x + 3ax^2 + x^3$ (the root required.)

$$\begin{array}{r} a^3 \\ \hline 3a^2 + 3ax + x^2 \quad 3a^2x + 3ax^2 + x^3 \\ \hline 3a^2x + 3ax^2 + x^3 \\ \hline * * * \end{array}$$

76. The reason of the preceding rule is evident from the composition of a cube, for if any quantity as $a+b+c$ be raised to the third power, we have $(a+b+c)^3 = a^3 + (3a^2 + 3ab + b^2)b + (3(a+b)^2 + 3(a+b)c + c^2)c$, and by considering in what manner the terms a , b , and c are developed from this expression for the cube of their sum, we also see the reason for the common rule for extracting the cube root in numbers. Let it be required to find the cube root of 13312053, where the root will evidently consist of three figures; let us suppose it to be represented by $a+b+c$, and the operation for finding the numerical values of these quantities may stand as follows.

olution. The operation as performed by the common rule (see ARITHMETIC) will stand thus :

$$\begin{array}{r}
 13312053(237 \text{ the root required.} \\
 8 \\
 \hline
 12 \dots 5312 \\
 18 \dots \\
 9 \\
 \hline
 1389 \dots 4167 \\
 \hline
 1587 \dots 1145053 \\
 483 \dots \\
 49 \\
 \hline
 163579 \dots 1145053
 \end{array}$$

77. III. To extract any other root.

Rule. Range the quantity of which the root is to be found, according to the powers of its letters, and extract the root of the first term, and that shall be the first member of the root required.

Involve the first member of the root to a power less by unity than the number that denominates the root required, and multiply the power that arises by the number itself; divide the second term of the given quantity by the product, and the quotient shall give the second member of the root required.

Find the remaining members of the root in the same manner by considering those already found as making one term.

Ex. Required the cube root of $x^6 + 6x^5 - 40x^3 + 96x - 64$

$$\begin{array}{r}
 x^6 + 6x^5 - 40x^3 + 96x - 64(x^3 + 2x - 4) \\
 (x^3)^3 = x^9 \\
 \hline
 3x^4 6x^5 \\
 \hline
 (x^3 + 2x)^3 = x^9 + 6x^5 + 12x^4 + 8x^3 \\
 \hline
 3x^4 +, \&c.) - 12x^4 \\
 \hline
 (x^3 + 2x - 4)^3 = x^9 + 6x^5 - 40x^3 + 96x - 64 \\
 \hline
 *
 \end{array}$$

In this example, the cube root of x^6 , or x^2 , is the first member of the root, and to find a second member the first is raised to the power next lower, or to the second power, and also multiplied by 3, the index of the root required; thus we get $3x^4$ for a divisor, by which the second term $6x^5$ being divided, we find $2x$ for the second member of the root. We must now consider $x^3 + 2x$ as forming one term; accordingly having subtracted its cube from the quantity, of which the root is sought, we have $-12x^4$, &c. for a new dividend; and having also raised $x^2 + 2x$ to the second power, and multiplied the result by 3, we find $3x^4 +$, &c. for a divisor. As it is only the terms which contain the highest powers of the dividend and divisor that we have occasion for, the remaining terms are expressed by &c. Having divided $-12x^4$ by $3x^4$, we find -4

2

for the third term of the root; and because it appears that $x^3 + 2x - 4$, when raised to the third power, gives a result the very same with the proposed power, we conclude $x^3 + 2x - 4$ to be the root sought.

78. In the preceding examples, the quantities whose roots were to be found have been all such as could have their roots expressed by a finite number of terms; but it will frequently happen that the root cannot be otherwise assigned than by a series consisting of an infinite number of terms: the preceding rules, however, will serve to determine any number of terms of the series. Thus the square root of $a^3 + x^2$ will be found to be $a + \frac{x^2}{2a} - \frac{x^4}{8a^3} + \frac{a^6}{10a^5} - \frac{5x^8}{128a^7} + \&c.$ and the cube

root of $a^3 + x^3$ will stand thus, $a + \frac{x^3}{3a^2} - \frac{x^6}{9a^5} + \frac{5x^9}{81a^8} - \frac{10x^{12}}{243a^{11}} + \&c.$; but as the extraction of roots in the form of series can be more easily performed by other methods, we shall refer the reader to sect. 19. which treats of series, where this subject is again resumed.

SECT. IV. Of Surds.

79. It has been already observed (71.), that the root of any proposed quantity is found by dividing the exponent of the quantity by the index of the root; and the rule has been illustrated by suitable examples, in all which, however, the quotient expressing the exponent of the result is a whole number; but there may be cases in which the quotient is a fraction. Thus if the cube root of a^2 were required, it might be expressed, agreeably to the method of notation already explained, either thus $\sqrt[3]{a^2}$, or thus $a^{\frac{2}{3}}$.

80. Quantities which have fractional exponents are called *surds*, or imperfect powers, and are said to be *irrational*, in opposition to others with integral exponents, which are called *rational*.

81. Surds may be denoted by means of the radical sign, but it will be often more convenient to use the notation of fractional exponents; the following examples will shew how they may be expressed either way.

$$\begin{array}{l}
 \sqrt[3]{a} = a^{\frac{1}{3}}, \quad \sqrt[4]{ab^2} = 2ba^{\frac{1}{4}}, \quad \sqrt[4]{a^3b^2} = a^{\frac{3}{4}}b^{\frac{1}{2}}, \quad \sqrt{a^2 + b^2} \\
 = (a^2 + b^2)^{\frac{1}{2}}, \quad \sqrt[5]{(a-b)^2} = (a-b)^{\frac{2}{5}}, \quad \frac{\sqrt{a+b}}{\sqrt{ab}} = (a+b)^{\frac{1}{2}} \\
 a^{-\frac{1}{2}}b^{-\frac{1}{2}}.
 \end{array}$$

82. The operations concerning surds depend on the following principle. If the numerator and denominator of a fractional exponent be either both multiplied, or both divided by the same quantity, the value of the power is the same. Thus $a^{\frac{m}{n}} = a^{\frac{cm}{cn}}$. For let $a^{\frac{m}{n}} = b$, then raising both to the power n , $a^m = b^n$, and farther raising both to the power c we get $a^{cm} = b^{cn}$; let the root cn be now taken, and we find $a^{\frac{cm}{cn}} = b^{\frac{n}{cn}}$.

83. PROB. I. To Reduce a rational Quantity to the form of a Surd of any given denomination.

Rule. Reduce the exponent of the quantity to the form of a fraction of the same denomination as the given surd.

Ex. 1.

Surd.

Ex. 1. Reduce a^2 to the form of the cube root.

Here the exponent 2 must be reduced to the form of a fraction having 3 for a denominator, which will be the fraction $\frac{2}{3}$; therefore $a^2 = a^{\frac{2}{3}} = \sqrt[3]{a^2}$.

Ex. 2. Reduce 5 to the form of the cube root, and $3ab^2$ to the form of the square root.

$$\text{First } 5 = 5^{\frac{1}{3}} = \sqrt[3]{5 \times 5 \times 5} = \sqrt[3]{125}.$$

$$\text{And } 3ab^2 = 3^{\frac{1}{2}} a^{\frac{1}{2}} b^{\frac{2}{2}} = (3^2 a^2 b^4)^{\frac{1}{2}} = \sqrt{9a^2 b^4}.$$

84. PROB. II. *To Reduce Surds of different denominations to others of the same value, and of the same denominations.*

Rule. Reduce the fractional exponents to others of the same value, and having the same common denominator.

Ex. 1. Reduce \sqrt{a} and $\sqrt[3]{b^2}$, or $a^{\frac{1}{2}}$ and $b^{\frac{2}{3}}$ to other equivalent surds of the same denomination.

The exponents $\frac{1}{2}$, $\frac{2}{3}$, when reduced to a common denominator, are $\frac{3}{6}$ and $\frac{4}{6}$; therefore, the surds required are $a^{\frac{3}{6}}$ and $b^{\frac{4}{6}}$, or $\sqrt[6]{a^3}$ and $\sqrt[6]{b^4}$.

Ex. 2. Reduce $3^{\frac{1}{2}}$ and $2^{\frac{1}{3}}$ to surds of the same denomination.

The new exponents are $\frac{3}{6}$ and $\frac{2}{6}$, therefore we have $3^{\frac{1}{2}} = 3^{\frac{3}{6}} = \sqrt[6]{3^3} = \sqrt[6]{27}$, and $2^{\frac{1}{3}} = 2^{\frac{2}{6}} = \sqrt[6]{2^2} = \sqrt[6]{4}$.

And in the same way the surds $A^{\frac{m}{n}}$, $B^{\frac{p}{q}}$ are reduced to these two $\sqrt[n]{A^m}$ and $\sqrt[n]{B^p}$.

85. PROB. III. *To Reduce Surds to their most simple terms.*

Rule. Reduce the surd into two factors, so that one of them may be a complete power, having its exponent divisible by the index of the surd. Extract the root of that power, and place it before the remaining quantities with the proper radical sign between them.

Ex. 1. Reduce $\sqrt{48}$ to its most simple terms.

The number 48 may be resolved into the two factors 16 and 3, of which the first is a complete square; therefore $\sqrt{48} = (4^2 + 3)^{\frac{1}{2}} = 4 \times 3^{\frac{1}{2}} = 4\sqrt{3}$.

Ex. 2. Reduce $\sqrt{98a^2x}$, and $\sqrt[3]{24a^3x + 40a^3x^2}$, each to its most simple terms.

$$\text{First } \sqrt{98a^2x} = (7^2 a^2 \times x)^{\frac{1}{2}} = 7a \times (2x)^{\frac{1}{2}} = 7a\sqrt{2x}.$$

$$\text{Also } \sqrt[3]{24a^3x + 40a^3x^2} = (2^3 a^3 (3x + 5x^2))^{\frac{1}{3}} = 2a\sqrt[3]{3x + 5x^2}.$$

86. PROB. IV. *To Add and Subtract Surds.*

Rule. If the surds are of different denominations, reduce them to others of the same denomination, by

3

prob. 2.; and then reduce them to their simplest terms by last problem. Then, if the surd part be the same in them all, annex it to the sum, or difference of the rational parts, with the sign of multiplication, and it will give the sum, or difference required. But if the surd part be not the same in all the quantities, they can only be added or subtracted by placing the signs + or - between them.

Ex. 1. Required the sum of $\sqrt{27}$ and $\sqrt{48}$.

By prob. 3. we find $\sqrt{27} = 3\sqrt{3}$ and $\sqrt{48} = 4\sqrt{3}$, therefore $\sqrt{27} + \sqrt{48} = 3\sqrt{3} + 4\sqrt{3} = 7\sqrt{3}$.

Ex. 2. Required the sum of $3\sqrt[3]{\frac{1}{2}}$ and $5\sqrt[3]{\frac{1}{12}}$.

$3\sqrt[3]{\frac{1}{2}} = 3\sqrt[3]{\frac{3}{8}} = \frac{3}{2}\sqrt[3]{2}$ and $5\sqrt[3]{\frac{1}{12}} = 5\sqrt[3]{\frac{1}{4}} = \frac{5}{4}\sqrt[3]{2}$, therefore $3\sqrt[3]{\frac{1}{2}} + 5\sqrt[3]{\frac{1}{12}} = \frac{3}{2}\sqrt[3]{2} + \frac{5}{4}\sqrt[3]{2} = \frac{11}{4}\sqrt[3]{2}$.

Ex. 2. Required the difference between $\sqrt{80a^2x}$ and $\sqrt{20a^2x^3}$.

$\sqrt{80a^2x} = (4^2 a^2 \times 5x)^{\frac{1}{2}} = 4a\sqrt{5x}$, and $\sqrt{20a^2x^3} = (2^2 a^2 x^2 \times 5x)^{\frac{1}{2}} = 2ax\sqrt{5x}$; therefore $\sqrt{80a^2x} - \sqrt{20a^2x^3} = (4a^2 - 2ax)\sqrt{5x}$.

86. PROB. V. *To Multiply and Divide Surds.*

Rule. If they are surds of the same rational quantity, add and subtract their exponents.

But if they are surds of different rational quantities, let them be brought to others of the same denomination, by prob. 2. Then, by multiplying or dividing these rational quantities, their product, or quotient, may be set under the common radical sign.

Note. If the surds have any rational coefficients, their product or quotient must be prefixed.

Ex. 1. Required the product of $\sqrt[3]{a^2}$ and $\sqrt{a^2}$.

$$\sqrt[3]{a^2} \times \sqrt{a^2} = a^{\frac{2}{3}} \times a^{\frac{1}{2}} = a^{\frac{2}{3} + \frac{1}{2}} = a^{\frac{7}{6}} = \sqrt[6]{a^7}, \text{ Ans.}$$

Ex. 2. Divide $\sqrt{a^2 - b^2}$ by $\sqrt{a + b}$.

These surds when reduced to the same denomination are $(a^2 - b^2)^{\frac{1}{2}}$ and $(a + b)^{\frac{1}{2}}$. Hence $\frac{\sqrt{a^2 - b^2}}{\sqrt{a + b}}$

$$= \left(\frac{(a^2 - b^2)^3}{(a + b)^3} \right)^{\frac{1}{6}} = \left(\frac{(a + b)^3 (a - b)^3}{(a + b)^3} \right)^{\frac{1}{6}} = (a + b) (a - b)^{\frac{1}{2}}.$$

Ex. 3. Required the product of $5\sqrt{8}$ and $3\sqrt{5}$.

$$5\sqrt{8} \times 3\sqrt{5} = 5 \times 3 \times \sqrt{8} \times \sqrt{5} = 15 \times \sqrt{40} = 15 \times \sqrt{4 \times 10} = 30\sqrt{10}.$$

Ex. 4. Divide $8\sqrt[3]{56}$ by $4\sqrt[3]{2}$.

$$\frac{8\sqrt[3]{56}}{4\sqrt[3]{2}} = 2\sqrt[3]{\frac{56}{2}} = 2\sqrt[3]{28}.$$

Ex. 5.

Ex. 5. Required the product of $x^{\frac{r}{m}}$ and $x^{\frac{s}{n}}$; also the quotient arising from the division of $a^{\frac{r}{m}}$ by $b^{\frac{s}{n}}$.

$$\text{First } x^{\frac{r}{m}} \times x^{\frac{s}{n}} = x^{\frac{r}{m} + \frac{s}{n}} = x^{\frac{rn + sm}{mn}} = \sqrt[mn]{x^{rn + sm}},$$

$$\text{And } \frac{a^{\frac{r}{m}}}{b^{\frac{s}{n}}} = \left(\frac{a^n}{b^m}\right)^{\frac{r}{mn}} = \sqrt[mn]{\frac{a^{rn}}{b^{sm}}}.$$

88. PROB. VI. To Involve and Evolve Surds.

Surds are involved or evolved in the same manner as any other quantities, namely, by multiplying or dividing their exponents by the index of the power, or root required. Thus the square of $3\sqrt[3]{3}$ is $3 \times 3 \times (3)^{\frac{2}{3}} = 9\sqrt[3]{9}$. The n th power of $x^{\frac{r}{m}}$ is $x^{\frac{rn}{m}}$. The cube root of $\frac{1}{8}\sqrt{2}$ is $\frac{1}{2}(2)^{\frac{1}{6}} = \sqrt[6]{\frac{2}{2}}$ and the n th root of $x^{\frac{r}{m}}$ is $x^{\frac{r}{mn}}$.

89. If a compound quantity involve one or more surds, its powers may be found by multiplication. Thus the square of $3 + \sqrt{5}$ is found as follows:

$$\begin{array}{r} 3 + \sqrt{5} \\ 3 + \sqrt{5} \\ \hline 9 + 3\sqrt{5} \\ + 3\sqrt{5} + 5 \\ \hline \end{array}$$

$$9 + 6\sqrt{5} + 5 = 14 + 6\sqrt{5} \text{ the square re-}$$

quired.

90. The square root of a binomial, or residual surd $A + B$, or $A - B$, may be found thus. Take $\sqrt{A^2 - B^2} - D$;

$$\text{then } \sqrt{A + B} = \sqrt{\frac{A + D}{2}} + \sqrt{\frac{A - D}{2}},$$

$$\text{and } \sqrt{A - B} = \sqrt{\frac{A + D}{2}} - \sqrt{\frac{A - D}{2}}.$$

Thus the square root of $8 + 2\sqrt{7}$ is $1 + \sqrt{7}$; and the square root of $3 - \sqrt{8}$ is $\sqrt{2} - 1$. With respect to the extraction of the cube or any higher root, no general rule can be given.

SECT. V. Of Proportion.

91. IN comparing together any two quantities of the same kind in respect of magnitude, we may consider how much the one is greater than the other, or else how many times the one contains either the whole, or some part of the other; or, which is the same thing, we may consider either what is the difference between the quantities, or what is the quotient arising from the division of the one quantity by the other; the former of these is called their *arithmetical ratio*, and the latter their *geometrical ratio*. These denominations, however, have been assumed arbitrarily, and have little or no connexion with the relations they are intended to express.

I. Of Arithmetical Proportion.

92. When of four quantities the difference between the first and second is equal to the difference between the third and fourth, the quantities are called *arithme-*
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tical proportionals. Such, for example, are the numbers 2, 5, 9, 12; and, in general, the quantities $a, a + d, b, b + d$. If the two middle terms are equal, the quantities constitute what are called *three arithmetical proportionals*.

93. The most material property of four arithmetical proportionals is the following: If four quantities be arithmetically proportional, the sum of the extreme terms is equal to the sum of the means. Let the quantities be $a, a + d, b, b + d$, where d is the difference between the first and second, and also between the third and fourth, the sum of the extremes is $a + b + d$, and that of the means $a + d + b$; so that the truth of the proportion is evident. Hence it follows, that if any three quantities be arithmetically proportional, the sum of the two extremes is double the mean.

94. If any three terms of four arithmetical proportionals be given, the fourth may be found from the preceding proposition. Let a, b, c , be the first, second, and fourth terms, and let x the third term be required; because $a + c = b + x$; therefore $x = a + c - b$. In like manner any two of three arithmetical proportionals being supposed given, the remaining term may be readily found.

95. If a series of quantities be such, that the difference between any two adjacent terms is always the same, these terms form a *continued arithmetical proportion*. Thus the numbers 2, 4, 6, 8, 10, &c. form a series in continued arithmetical proportion, and, in general, such a series may be represented thus:

$a, a + d, a + 2d, a + 3d, a + 4d, a + 5d, a + 6d$, &c. where a denotes the first term and d the common difference.

By a little attention to this series, we readily discover that it has the following properties:

1. The last term of the series is equal to the first term, together with the common difference taken as often as there are terms after the first. Thus, when the number of terms is 7, the last term is $a + 6d$; and so on. Hence if x denote the last term, n the number of terms, and a and d express the first term and common difference, we have $x = a + (n - 1)d$.

2. The sum of the first and last term is equal to the sum of any two terms at the same distance from them. Thus suppose the number of terms to be 7, then the last term is $a + 6d$, and the sum of the first and last, $2a + 6d$; but the same is also the sum of the second and last but one, of the third and last but two, and so on till we come to the middle term, which, because it is equally distant from the extremes must be added to itself.

96. From this last mentioned property we derive a rule for finding the sum of all the terms of the series. For if the sum of the first and last be taken, as also the sum of the second and last but one, of the third and last but two, and so on along the series till we come to the sum of the last and first terms, it is evident that we shall have as many sums as there are terms, and each equal to the sum of the first and last terms; but the aggregate of those sums is equal to all the terms of the series taken twice, therefore the sum of the first and last term, taken as often as there are terms, is equal to twice the sum of all the terms, so that if s denote that sum, we have $2s = n(a + x)$, and $s = \frac{n}{2}(a + x)$.

Geometrical Proportion.

Hence the sum of the odd numbers 1, 3, 5, 7, 9, &c. continued to n terms, is equal to the square of the number of terms. For in this case $a=1$, $d=2$, $x=1+(n-1)d=2n-1$, therefore $s=\frac{n}{2}\times 2n=n^2$.

II. Of Geometrical Proportion.

97. When of four quantities, the quotient arising from the division of the first by the second is equal to that arising from the division of the third by the fourth, these quantities are said to be in *geometrical proportion*, or are called simply *proportionals*. Thus 12, 4, 15, 5, are four numbers in geometrical proportion; and, in general, na , a , nb , b may express any four proportionals, for $\frac{na}{a}=n$, and also $\frac{nb}{b}=n$.

98. To denote that any four quantities a , b , c , d , are proportional, it is common to place them thus, $a : b :: c : d$, or thus $a : b = c : d$, which notation, when expressed in words, is read thus, a is to b as c to d , or the ratio of a to b is equal to the ratio of c to d .

The first and third terms of a proportion are called the *antecedents*, and the second and fourth the *consequents*.

99. When the two middle terms of a proportion are the same, the remaining terms, and that quantity, constitute three geometrical proportionals; such are 4, 6, 9, and in general na , a , $\frac{a}{n}$. In this case the middle quantity is called a mean proportional between the other two.

100. The principal properties of four proportionals are the following:

1. If four quantities be proportionals, the product of the extremes is equal to the product of the means. Let a , b , c , d , be four quantities, such that $a : b :: c : d$; then from the nature of proportionals $\frac{a}{b} = \frac{c}{d}$; let these equal quotients be multiplied by bd , and we have $\frac{abd}{b} = \frac{cbd}{d}$, or $ad=bc$. Hence it follows, that when three quantities are proportional, the product of the extremes is equal to the square of the middle term. It also appears, that if any three of four proportionals be given, the remaining one may be found. Thus let a , b , c , the three first be given, and let it be required to find x the fourth term; because $a : b :: c : x$, $ax=bc$, and dividing by a , $x=\frac{bc}{a}$. This conclusion may be considered as a demonstration of what is called the rule of three in arithmetic.

2. If four quantities be such that the product of two of them is equal to the product of the other two, these quantities are proportionals.

Let a , b , c , d , be the quantities, which are such that $ad=cb$, if these equals be divided by bd , we get $\frac{ad}{bd} = \frac{cb}{bd}$ or $\frac{a}{b} = \frac{c}{d}$, hence it follows, from the definition

given of proportionals (§ 97.), that $a : b :: c : d$. From this property of proportionals it appears, that if three quantities be such that the square of one of them be equal to the product of the other two, these quantities are three proportionals.

101. If four quantities are proportional, that is, if $a : b :: c : d$, then will each of the following combinations or arrangements of the quantities be also four proportionals.

1st, By inversion $b : a :: d : c$

2d, By alternation $a : c :: b : d^*$

3d, By composition $a+b : a :: c+d : c$
or $a+b : b :: c+d : d$

4th, By division $a-b : a :: c-d : c$
or $a-b : b :: c-d : d$

5th, By mixing $a+b : a-b :: c+d : c-d$

6th, By taking any equimultiples of the antecedents, and also any equimultiples of the consequents

$na : pb :: nc : pd$

7th, Or by taking any parts of the antecedents and consequents $\frac{a}{n} : \frac{b}{p} :: \frac{c}{n} : \frac{d}{p}$.

That the preceding combinations of the quantities a , b , c , d are proportionals, may be readily proved, by taking the products of the extremes and means; for from each of them we derive this conclusion, that $ad=bc$, which is known to be true, from the original assumption of the quantities.

102. If four quantities be proportional, and also other four, the product of the corresponding terms will be proportional.

Let $a : b :: c : d$,

and $e : f :: g : h$,

Then $ae : bf :: cg : dh$.

For $ad=bc$, and $eh=fg$ (§ 100.), therefore, multiplying together these equal quantities $adeh=bcfg$, or $ae \times dh = bf \times cg$, therefore by the second property (§ 100.), $ae : bf :: cg : ah$.

103. Hence it follows, that if there be any number of proportions whatever, the products of the corresponding terms will still be proportional.

104. If a series of quantities be so related to each other, that the quotient arising from the division of any term by that which follows it is always the same quantity, these quantities are said to be in *continued geometrical proportion*, such are the numbers 2, 4, 8, 16, 32, &c. also $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, &c. and in general a series of such quantities may be represented thus, a , ar , ar^2 , ar^3 , ar^4 , ar^5 , &c. Here a is the first term, and r the quotient of any two adjoining terms, which is also called the *common ratio*.

105. By inspecting this series we find that it has the following properties:

1. The last term is equal to the first, multiplied by the common ratio raised to a power, the index of which is one less than the number of terms. Therefore, if x denote the last term, and n the number of terms, $x=ar^{n-1}$.

2. The

* The quantities in this case must be all of the same kind, that is, if a and b denote surfaces, then c and d must also denote surfaces, but they cannot represent lines, &c.

2. The product of the first and last term is equal to the product of any two terms equally distant from them: thus, supposing ar^5 the last term, it is evident that $a \times ar^5 = ar \times ar^4 = ar^2 \times ar^3$, &c.

106. The sum of all the terms may be found thus: let s represent that sum, then, supposing the number of terms to be six, $s = a + ar + ar^2 + ar^3 + ar^4 + ar^5$, and multiplying these equals by r , $sr = ar + ar^2 + ar^3 + ar^4 + ar^5 + ar^6$. If from the lower line, or $sr = ar + ar^2 + \dots + ar^6$, we subtract the upper line, or $s = a + ar + \dots + ar^5$, the remainders will evidently be equal; but on the one side of the sign $=$ we have $sr - s$, and on the other $ar^6 - a$: therefore, $sr - s = ar^6 - a$, and

dividing by $r - 1$, $s = \frac{ar^6 - a}{r - 1}$. Let us now, instead of

6, substitute n (for the number of terms put down was 6), and we have the following general rule for finding the sum of a series of quantities in continued geometrical

proportion, $s = \frac{ar^n - a}{r - 1}$, or $s = \frac{a(r^n - 1)}{r - 1}$.

SECT. VI. Of the Reduction of Equations involving one unknown quantity.

107. THE general object of algebraic investigation is to discover certain unknown quantities, by comparing them with other quantities which are given, or supposed to be known. The relation between the known and unknown quantities is either that of equality, or else such as may be reduced to equality; and a proposition which affirms that certain combinations of quantities are equal to one another is called an *equation*.

Such are the following, $\frac{x}{2} + \frac{x}{3} = \frac{24}{x}$, $2x + 3y = xy$;

the first of these equations expresses the relation between an unknown quantity x , and certain known numbers; and the second expresses the relation which the two indefinite quantities x and y have to each other.

108. When a quantity stands alone on one side of an equation, the terms on the other side are said to be a *value* of that quantity. Thus in the equation $x = ay + b - c$, the quantity x stands alone on one side, and $ay + b - c$ is its value.

109. The conditions of a problem may be such as to require several equations and symbols of unknown quantities for their complete expression; these, however, by rules hereafter to be explained, may be reduced to one equation, involving only one unknown quantity and its powers, besides the known quantities; and the method of expressing that quantity, by means of the known quantities, constitutes the theory of equations, one of the most important as well as most intricate branches of algebraic analysis.

110. An equation is said to be *resolved* when the unknown quantity is made to stand alone on one side, and only known quantities on the other side; and the value of the unknown quantity is called a *root* of the equation.

111. Equations containing only one unknown quantity and its powers, are divided into different *orders*, according to the highest power of that quantity contained in any one of its terms. The equation, however, is

supposed to be reduced to such a form, that the unknown quantity is found only in the numerators of the terms, and that the exponents of its powers are expressed by positive integers.

112. If an equation contains only the first power of the unknown quantity, it is called a *simple equation*, or an equation of the first order. Such is $ax + b = c$, where x denotes an unknown, and a, b, c known quantities.

113. If the equation contains the second power of the unknown quantity, it is said to be of the second degree, or is called a *quadratic equation*; such is $4x^2 + 3x = 12$, and in general $ax^2 + bx = c$. If it contains the third power of the unknown quantity, it is of the third degree, or is a *cubic equation*. Such are $x^3 - 2x^2 + 4x = 10$, and $ax^3 + bx^2 + cx = d$, and so on, with respect to equations of the higher orders. A simple equation is sometimes said to be *linear*, or to be of one *dimension*. In like manner, quadratic equations are said to be equations of two dimensions, and cubic equations to be of three dimensions.

114. When in the course of an algebraic investigation we arrive at an equation involving only one unknown quantity, that quantity will often be so entangled in the different terms, as to render several previous reductions necessary before the equation can be expressed under its characteristic form, so as to be resolved by the rules which belong to that form.

These reductions depend upon the operations which have been explained in the former part of this treatise, and the application of a few self-evident principles, namely, that if equal quantities be added to, or subtracted from equal quantities, the sums or remainders will be equal; if equal quantities be multiplied, or divided by the same quantity, the products or quotients will be equal; and, lastly, if equal quantities be raised to the same power, or have the same root extracted out of each, the results will still be equal.

From these considerations are derived the following rules, which apply alike to equations of all orders, and are alone sufficient for the resolution of simple equations.

115. *Rule 1.* Any quantity may be transposed from one side of an equation to the other, by changing its signs.

Thus, if $x - 3 = 5$

Then $x = 5 + 3$

Or $x = 8$

And if $3x - 10 = 2x + 5$

Then $3x - 2x = 5 + 10$

Or $x = 15$

Again, if $ax + b = cx - dx + e$

Then $ax - cx + dx = e - b$

Or $(a - c + d)x = e - b$

The reason of this rule is evident, for the transposing a quantity from one side of an equation to the other is nothing more than adding the same quantity to each side of the equation, if the sign of the quantity transposed was $-$; or subtracting it, if the sign was $+$.

From this rule we may infer, that if any quantity be found on each side of the equation with the same sign, it may be left out of both. Also, that the signs of all the terms of an equation may be changed into

Reduction of Equations. the contrary without affecting the truth of the equation.

$$\begin{aligned}\text{Thus, if } a+x &= b+a-c \\ \text{Then } x &= b+c \\ \text{And if } a-x &= b-d \\ \text{Then } x &= a+d-b.\end{aligned}$$

116. *Rule 2.* If the unknown quantity in an equation be multiplied by any quantity, that quantity may be taken away, by dividing all the other terms of the equation by it.

$$\begin{aligned}\text{If } 3x &= 24 \\ \text{Then } x &= \frac{24}{3} = 8 \\ \text{If } ax &= b-c \\ \text{Then } x &= \frac{b-c}{a} = \frac{b}{a} - \frac{c}{a}.\end{aligned}$$

Here equal quantities are divided by the same quantity, and therefore the quotients are equal.

117. *Rule 3.* If any term of an equation be a fraction, its denominator may be taken away by multiplying all the other terms of the equation by that denominator.

$$\begin{aligned}\text{If } \frac{x}{5} &= 7 \\ \text{Then } x &= 35 \\ \text{If } \frac{x}{a} &= b-c+d \\ \text{Then } x &= ab-ac+ad \\ \text{If } a\frac{b}{x} &= c, \\ ax-b &= cx.\end{aligned}$$

In these examples, equal quantities are multiplied by the same quantity, and therefore the products are equal.

118. The denominators may be taken away from several terms of an equation by one operation, if we multiply all the terms by any number which is a multiple of each of these denominators.

$$\text{Thus, if } \frac{x}{2} + \frac{x}{3} + \frac{x}{4} = 26.$$

Let all the terms be multiplied by 12, which is a multiple of 2, 3, and 4, and we have

$$\begin{aligned}\frac{12x}{2} + \frac{12x}{3} + \frac{12x}{4} &= 312 \\ \text{Or } 6x + 4x + 3x &= 312 \\ \text{Hence } 12x &= 312\end{aligned}$$

$$\text{Universally, if } \frac{x}{a} - \frac{x}{b} + \frac{x}{c} = d-e.$$

To take away the denominators a, b, c , let the whole equation be multiplied by abc , their product, and we have

$$\begin{aligned}bcx - acx + abx &= abc(d-e) \\ \text{Or } (bc-ac+ab)x &= abc(d-e).\end{aligned}$$

119. From the two last rules it appears that if all the terms of an equation be either multiplied or divided by the same quantity, that quantity may be left out of all the terms.

$$\begin{aligned}\text{If } ax &= ab-ac \\ \text{Then } x &= b-c \\ \text{And if } \frac{x}{a} &= \frac{b}{a} + \frac{c}{n} \\ \text{Then } x &= b+c.\end{aligned}$$

120. *Rule.* If the unknown quantity is found in any term which is a surd, let that surd be made to stand alone on one side of the equation, and the remaining terms on the opposite side; then involve each side to a power denoted by the index of the surd, and thus the unknown quantity shall be freed from the surd expression.

$$\begin{aligned}\text{If } \sqrt{x} + 6 &= 10 \\ \text{Then by transposition } \sqrt{x} &= 10-6=4 \\ \text{And squaring both sides } \sqrt{x} \times \sqrt{x} &= 4 \times 4 \\ \text{Or } x &= 16.\end{aligned}$$

$$\begin{aligned}\text{Also, if } \sqrt{a^2+x^2} &= b+x \\ \text{By trans. } \sqrt{a^2+x^2} &= b+x \\ \text{And squaring, } a^2+x^2 &= (b+x)^2 = b^2+2bx+x^2 \\ \text{Hence } a^2 &= b^2+2bx.\end{aligned}$$

$$\begin{aligned}\text{And if } \sqrt{a^2x-b^2x} &= a \\ \text{Then } a^2x-b^2x &= a^2.\end{aligned}$$

121. *Rule.* If the side of the equation, which contains the unknown quantity, be a perfect power, the equation may be reduced to another of a lower order, by extracting the root of that power out of each side of the equation.

$$\begin{aligned}\text{Thus if } x^3 &= 64a^3 \\ \text{Then, by extracting the cube root, } x &= 8a \\ \text{And if } (a+x)^3 &= b^3-a^2 \\ \text{Then } a+x &= \sqrt[3]{b^3-a^2}.\end{aligned}$$

122. The use of the preceding rules will be farther illustrated by the following examples:

$$\text{Ex. 1. Let } 20-3x-8=60-7x$$

$$\begin{aligned}\text{By rule 1. } 7x-3x &= 60+8-20 \\ \text{Or } 4x &= 48 \\ \text{Therefore by rule 2. } x &= 12.\end{aligned}$$

$$\text{Ex. 2. Let } ax-b=cx+d$$

$$\begin{aligned}\text{By rule 1. } ax-cx &= b+d \\ \text{Or } (a-c)x &= b+d \\ \text{And by rule 2. } x &= \frac{b+d}{a-c}.\end{aligned}$$

$$\text{Ex. 3. Let } \frac{x+1}{2} + \frac{x+2}{3} = 16 - \frac{x+3}{4}$$

$$\begin{aligned}\text{By rule 3. } \left\{ \begin{aligned} x+1 + \frac{2x+4}{3} &= 32 - \frac{2x+6}{4} \\ 3x+3+2x+4 &= 96 - \frac{6x+18}{4} \\ 12x+12+8x+16+384-6x-18 &= 366-6x \end{aligned} \right. \\ \text{Or } 20x+28 &= 366-6x\end{aligned}$$

$$\begin{aligned}\text{Hence, by rule 1. } 26x &= 338 \\ \text{And by rule 2. } x &= 13.\end{aligned}$$

In this example, instead of taking away the denominators one after another, they might have been all taken away at once, by multiplying the given equation by

duction by 12, which is divisible by the numbers 2, 3, and 4; thus we should have got $6x+6+4x+8=192-3x-9$, and hence, as before, $x=13$.

Ex. 4. Let $6x^2-20x^2=16x^2+2x^2$.

Then dividing by $2x^2$, $3x-10=8+x$
 And transposing, $3x-x=8+10$
 Or $2x=18$
 And therefore $2x=9$.

Ex. 5. Let $a-\frac{b^2}{x}=c$

Then $ax-b^2=cx$
 And $ax-cx=b^2$

Whence $x=\frac{b^2}{a-c}$.

Ex. 6. Let $x-6=\frac{x^2}{x+24}$.

Then $(x-6)(x+24)=x^2$
 That is, $x^2+18x-144=x^2$
 Therefore $18x=144$
 And $x=8$.

Ex. 7. Let $ax+b^2=\frac{ax^2+ac^2}{a+x}$.

Then $(a+x)(ax+b^2)=ax^2+ac^2$
 Or $a^2x+ab^2+ax^2+b^2x=ax^2+ac^2$
 Hence $a^2x+b^2x=ac^2-ab^2$
 And $x=\frac{ac^2-ab^2}{a^2+b^2}$.

Ex. 8. Let $\frac{1-x}{1+a}=a$.

Then $1-x=a+ax$
 And $-x-ax=a-1$

Or changing the signs, $x+ax=1-a$

Hence, $x=\frac{1-a}{1+a}$.

Ex. 9. Let $\sqrt{12+x}=2+\sqrt{x}$.

Then by rule 4. $12+x=4+4\sqrt{x}+x$
 And by transposition $8=4\sqrt{x}$
 And by division $2=\sqrt{x}$
 And again by rule 4. $4=x$.

Ex. 10. Let $x+\sqrt{a^2+x^2}=\frac{2a^2}{\sqrt{a^2+x^2}}$.

Then, by rule 3. $x\sqrt{a^2+x^2}+a^2+x^2=2a^2$
 And by transposition, &c. $x\sqrt{a^2+x^2}=a^2-x^2$
 Therefore, by rule 4. $a^2x^2+x^4=a^4-2a^2x^2+x^4$
 Whence $3a^2x^2=a^4$

And $x^2=\frac{a^2}{3}$, therefore, rule 5. $x=\frac{a}{\sqrt{3}}$

Ex. 11. Let $\frac{1-\sqrt{1-x^2}}{1+\sqrt{1-x^2}}=a$.

Then $1-\sqrt{1-x^2}=a+a\sqrt{1-x^2}$

And $1-a=a\sqrt{1-x^2}+\sqrt{1-x^2}=(1+a)\sqrt{1-x^2}$
 Whence $\frac{1-a}{1+a}=\sqrt{1-x^2}$

And, taking the square of both sides, $\frac{(1-a)^2}{(1+a)^2}=1-x^2$

Therefore, by transposition, $x^2=1-\frac{(1-a)^2}{(1+a)^2}$

That is, $x^2=\frac{(1+a)^2-(1-a)^2}{(1+a)^2}=\frac{4a}{(1+a)^2}$

Therefore $x=\frac{2\sqrt{a}}{1+a}$.

Ex. 12. Let $a+x=\sqrt{a^2+x}\sqrt{b^2+x^2}$

Then $(a+x)^2=a^2+x\sqrt{b^2+x^2}$
 That is, $a^2+2ax+x^2=a^2+x\sqrt{b^2+x^2}$
 Therefore $2ax+x^2=x\sqrt{b^2+x^2}$
 And dividing by x , $2a+x=\sqrt{b^2+x^2}$

Again taking the squares of both sides, $4a^2+4ax+x^2=b^2+x^2$

Whence $4a^2+4ax=b^2$

And $4ax=b^2-4a^2$; so that $x=\frac{b^2-4a^2}{4a}$.

123. In all these examples we have been able to determine the value of the unknown quantity by the rules already delivered, because in every case the first, or at most the second power of that quantity, has been made to stand alone on one side of the equation, while the other consisted only of known quantities; but the same methods of reduction serve to bring equations of all degrees to a proper form for solution. Thus if

$\frac{1-p+q+r}{x+1}=1-p-x+\frac{r}{x}$; by proper reduction, we

have $x^3+px^2+qx=r$, a cubic equation, which may be resolved by rules to be afterwards explained.

SECT. VII. Of the Reduction of Equations involving more than one unknown quantity.

124. HAVING shown in the last section in what manner an equation involving one unknown quantity may be resolved, or at least fitted for a final solution, we are next to explain the methods by which two or more equations, involving as many unknown quantities, may at last be reduced to one equation, and one unknown quantity.

As the unknown quantities may be combined together in very different ways, so as to constitute an equation, the methods most proper for their extermination must therefore be various. The three following, however, are of general application, and the last of them may be used with advantage, not only when the unknown quantity to be exterminated arises to the same power in all the equations, but also when the equations contain different powers of that quantity.

125. Method 1. Observe which of the unknown quantities is the least involved, and let its value be found from each equation by the rules of last section.

Let the values thus found be put equal to each other, and hence new equations will arise, from which that

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Reduction of Equations. that quantity is wholly excluded. Let the same operation be now repeated with the same equations, and the unknown quantities exterminated one by one, till at last an equation be found, which contains only one unknown quantity.

Ex. Let it be required to determine x and y from these two equations.

$$\begin{aligned} 2x + 3y &= 23 \\ 5x - 2y &= 10 \end{aligned}$$

From the first equation $2x = 23 - 3y$

And $x = \frac{23 - 3y}{2}$

From the second equation $5x = 10 + 2y$

And $x = \frac{10 + 2y}{5}$

Let these values of x be now put equal to each other,

And we have $\frac{10 + 2y}{5} = \frac{23 - 3y}{2}$

Or $20 + 4y = 115 - 15y$

Therefore $19y = 95$

And $y = 5$

And since $x = \frac{23 - 3y}{2}$, or $x = \frac{10 + 2y}{5}$, from either of these values we find $x = 4$.

126. *Method 2.* Let the value of the unknown quantity, which is to be exterminated, be found from that equation wherein it is least involved. Let this value, and its powers, be substituted for that quantity, and its respective powers in the other equations; and with the new equations thus arising, let the operation be repeated, till there remain only one equation, and one unknown quantity.

Ex. Let the given equations, as in last method, be

$$\begin{aligned} 2x + 3y &= 23 \\ 5x - 2y &= 10 \end{aligned}$$

From the first equation $x = \frac{23 - 3y}{2}$

And this value of x being substituted in the second equation, we have $5 \times \frac{23 - 3y}{2} - 2y = 10$

Or $115 - 15y - 4y = 20$

Therefore $95 = 19y$

And $5 = y$

And hence $x = \frac{23 - 3y}{2} = 4$, as before.

127. *Method 5.* Let the given equation be multiplied or divided by such numbers or quantities, whether known or unknown, that the term which involved the highest power of the unknown quantity may be the same in each equation.

Then by adding or subtracting the equations, as occasion may require, that term will vanish, and a new equation emerge, wherein the number of dimensions of the unknown quantity in some cases, and in others the number of unknown quantities, will be diminished; and by a repetition of the same, or similar operations,

a final equation may be at last obtained, involving only one unknown quantity.

Ex. Let the same example be taken, as in the illustration of the two former methods, namely,

$$\begin{aligned} 2x + 3y &= 23 \\ 4x - 2y &= 10 \end{aligned}$$

and from these two equations we are to determine x and y . To exterminate x , let the first equation be multiplied by 8, and the second by 2, thus we have

$$\begin{aligned} 16x + 24y &= 184 \\ 8x - 4y &= 20 \end{aligned}$$

Here the term involving x is the same in both equations, and it is obvious that by subtracting the one from the other, the resulting equation will contain only y , and known numbers, for by such subtraction we find $19y = 95$, and therefore $y = 5$.

Having got the value of y , it is easy to see how x may be found, from either of the given equations; but it may also be found in the same manner as we found y . For let the first of the given equations be multiplied by 2, and the second by 3, and we have

$$\begin{aligned} 4x + 6y &= 46 \\ 12x - 6y &= 30 \end{aligned}$$

By adding these equations, we find

$$16x = 76$$

and therefore $x = 4$.

128. The following examples will serve farther to illustrate these different methods of exterminating the unknown quantities from equations.

Ex. 1. Given $\left\{ \begin{aligned} \frac{x}{2} + \frac{y}{3} &= 16 \\ \frac{x}{5} - \frac{y}{9} &= 2 \end{aligned} \right\}$ Required x and y .

By Method 1.

From the first equation we find $x = 32 - \frac{2y}{3}$

And from the second $x = 10 + \frac{5y}{9}$

Therefore $10 + \frac{5y}{9} = 32 - \frac{2y}{3}$

Or $90 + 5y = 288 - 6y$

Hence $11y = 198$

And $y = 18$

The value of y being substituted in either of the values of x , namely, $32 - \frac{2y}{3}$ or $10 + \frac{5y}{9}$ we find $x = 20$.

By Method 2.

Having found from the first given equation $x = 32 - \frac{2y}{3}$, let this value of x be substituted in the second, thus we have

$$\frac{1}{5} \left(32 - \frac{2y}{3} \right) - \frac{y}{9} = 2$$

Or $\frac{32}{5} - \frac{2y}{15} - \frac{y}{9} = 2$

Hence $198 = 11y$

And $18 = y$

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ations.
The value of y being now substituted in either of the given equations, we thence find $x=20$ as before.

By Method 3.

The denominators of the two given equations being taken away by rule 3. of last section, we have

$$\begin{aligned} 3x+2y &= 96 \\ 9x-5y &= 90 \end{aligned}$$

From three times the first of these equations, or $9x+6y=288$, let the second be subtracted, and there remains

$$11y=198$$

$$\text{And hence } y=18$$

The value of y being now substituted in either of the equations $3x+2y=96$, $9x-5y=90$, we readily find $x=20$.

129. Having now shewn in what manner the different methods of exterminating the unknown quantities may be applied, we shall, in the remaining examples of this section, chiefly make use of the last method, because it is the most easy and expeditious in practice.

$$\text{Ex. 2. Given } \left\{ \begin{aligned} \frac{x}{2} - 12 &= \frac{y}{4} + 8 \\ \frac{x+y}{5} + \frac{x}{3} - 8 &= \frac{2y-x}{4} + 27 \end{aligned} \right\}$$

It is required to determine x and y .

From the 1st equation we have $4x-96=2y+64$.

And from the second, $12x+12y+20x-480=30y-15x+1620$.

These two equations, when abridged, become

$$\begin{aligned} 4x-2y &= 160 \\ 47x-18y &= 2100 \end{aligned}$$

To exterminate y ; from this last equation let 9 times the one preceding it be subtracted.

$$\text{Thus we find } 11x=660$$

$$\text{And } x=60$$

$$\text{And because } 2y=4x-160=80$$

$$\text{Therefore } y=40.$$

$$\text{Ex. 3. Given } \left\{ \begin{aligned} ax+by &= c \\ dx+fy &= g \end{aligned} \right\} \text{ To determine } x \text{ and } y.$$

To exterminate y , let the first equation be multiplied by f , and the second by b , and we have

$$\begin{aligned} afx+bfy &= cf \\ bdx+bfy &= bg \end{aligned}$$

Taking now the difference between these equations, we find

$$\text{Or } (af-bd)x=cf-bg$$

$$\text{And therefore } x=\frac{cf-bg}{af-bd}$$

In the same manner may y be determined, by multiplying the first of the given equations by d , and the second by a ; for we find

$$\begin{aligned} adx+bdy &= cd \\ adx+afy &= ag \end{aligned}$$

and taking the difference as before, we get

$$bdy-afy=cd-ag$$

And therefore

$$y=\frac{cd-ag}{bd-af}$$

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This last example may be considered as a general solution of the following problem. Two equations expressing the relation between the first powers of two unknown quantities being given, to determine those quantities. For whatever be the number of terms in each equation, it will readily appear, as in example 2d, that by proper reduction, they may be brought to the same form as those given in the 3d example.

130. Let us next consider such equations as involve three unknown quantities.

$$\text{Ex. 4. Given } \left\{ \begin{aligned} x+y+z &= 29 \\ x+2y+3z &= 62 \\ \frac{x}{2} + \frac{y}{3} + \frac{z}{4} &= 10 \end{aligned} \right\} \text{ To find } x, y, \text{ and } z.$$

We shall in this example proceed according to the rules of the first method for exterminating the unknown quantities.

$$\text{From the first equation } x=29-y-z$$

$$\text{From the second } x=62-2y-3z$$

$$\text{From the third } x=20-\frac{2y}{3}-\frac{z}{2}$$

Let these values of x be put equal to each other, thus we get the two following equations,

$$29-y-z=62-2y-3z$$

$$29-y-z=20-\frac{2y}{3}-\frac{z}{2}$$

Again, from these two equations, by transposition, &c. we find

$$y=33-2z$$

$$y=27-\frac{3z}{2}$$

$$\text{Therefore } 33-2z=27-\frac{3z}{2}$$

$$\text{And hence, by reduction, } z=12$$

$$\text{Whence also } y=33-2z=9$$

$$\text{And } x=29-y-z=8.$$

$$\text{Ex. 5. Given } \left\{ \begin{aligned} \frac{x}{2} + \frac{y}{3} + \frac{z}{4} &= 62 \\ \frac{x}{3} + \frac{y}{4} + \frac{z}{5} &= 47 \\ \frac{x}{4} + \frac{y}{5} + \frac{z}{6} &= 38 \end{aligned} \right\} \text{ To find } x, y, \text{ and } z$$

Here the given equations, when cleared from fractions, become

$$12x+8y+6z=1488$$

$$20x+15y+12z=2820$$

$$30x+24y+20z=4560$$

To exterminate z by the third method, let the first equation be multiplied by 10, the second by 5, and the third by 3, the results will be these:

$$120x+80y+60z=14880$$

$$100x+75y+60z=14100$$

$$90x+72y+60z=13680$$

Let

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Let the second equation be now subtracted from the first, and the third from the second, and we have

$$\begin{aligned} 20x + 5y &= 780 \\ 10x + 3y &= 420 \end{aligned}$$

Next to exterminate y , let the first of these equations be multiplied by 3, and the second by 5, hence

$$\begin{aligned} 60x + 15y &= 2340 \\ 50x + 15y &= 2100 \end{aligned}$$

Subtracting now the latter equation from the former,

$$\begin{aligned} \text{Hence} \quad 10x &= 240 \\ x &= 24 \\ \text{Therefore} \quad y &= \frac{420 - 10x}{3} = 60 \\ \text{And} \quad z &= \frac{1448 - 12x - 8y}{6} = 120 \end{aligned}$$

131. From the preceding examples, it is manifest in what manner any number of unknown quantities may be determined, by an equal number of equations, which contain only the first power of those quantities, in the numerators of the terms. Such are the following.

$$\begin{aligned} ax + by + cz &= n \\ dx + ey + fz &= p \\ gx + hy + kz &= q \end{aligned}$$

where a, b, c , &c. represent known, and x, y, z , unknown quantities; and in every case of this kind, the unknown quantities may be directly found, for they will be always expressed by whole numbers, or rational fractions, provided that the known quantities a, b, c , &c. are also rational.

132. We shall now add a few examples, in which the equations that result from the extermination of an unknown quantity arise to some of the higher degrees; and therefore their final solution must be referred to the sections which treat of those degrees.

Ex. 6. Let $x - y = 2$, and $xy + 5x - 6y = 120$; it is required to exterminate x .

From the first equation $x = y + 2$; which value being substituted in the other equation according to the second general method (§ 126.) it becomes

$$\begin{aligned} (y+2)y + 5(y+2) - 6y &= 120 \\ \text{that is } y^2 + 2y + 5y + 10 - 6y &= 120 \end{aligned}$$

therefore the equation required is $y^2 + y = 110$.

Ex. 7. There is given $x + y = a$, and $x^2 + y^2 = b$; to exterminate x .

From the first equation $x = a - y$, and $x^2 = (a - y)^2$. And from the second $x^2 = b - y^2$.

$$\text{Therefore } (a - y)^2 = b - y^2$$

$$\text{That is } a^2 - 2ay + y^2 = b - y^2$$

Hence $2y^2 - 2ay = b - a^2$; an equation involving only y .

Ex. 8. Given $\begin{cases} axy + bx + cy = d \\ fxy + gx + hy = k \end{cases}$ To exterminate y .

From the first equation we find $y = \frac{d - bx}{ax + c}$

And from the second $y = \frac{k - gx}{fx + b}$

Therefore $\frac{d - bx}{ax + c} = \frac{k - gx}{fx + b}$, an equation in which the unknown quantity is found. Simple Equations.

Ex. 9. Given $\begin{cases} y^2 - 3xy + ay = x^2 \\ y^2 + 2ax - by = 4x^2 - b^2 \end{cases}$ To exterminate y .

As the coefficient of y^2 is unity in both equations, if their difference be taken, the highest power of y will vanish; but to give a general solution, let the terms of the equations be brought all to one side and made equal to 0, thus,

$$\begin{aligned} y^2 - (3x - a)y - x^2 &= 0 \\ y^2 - by + 2ax - 4x^2 + b^2 &= 0 \end{aligned}$$

Let us in the first equation put $1 = A$, $-(3x - a) = B$, $-x^2 = C$; and in the second, $1 = D$, $-b = E$, $2ax - 4x^2 + b^2 = F$, and the two equations become

$$\begin{aligned} Ay^2 + By + C &= 0 \\ Dy^2 + Ey + F &= 0 \end{aligned}$$

To exterminate y^2 , let the first equation be multiplied by D , and the second by A , and we have

$$\begin{aligned} ADy^2 + BDy + CD &= 0 \\ ADy^2 + AEy + AF &= 0 \end{aligned}$$

Therefore, taking the difference of these equations,

$$(BD - AE)y + CD - AF = 0$$

$$\text{And } y = \frac{AF - CD}{BD - AE}$$

Again, to find another value of y , multiply the first equation by F , and the second by C , then

$$\begin{aligned} AFy^2 + BFy + CF &= 0 \\ CDy^2 + CEy + CF &= 0 \end{aligned}$$

Therefore, subtracting as before, we get

$$(AF - CD)y^2 + (BF - CE)y = 0$$

And dividing by $y(AF - CD)y + BF - CE = 0$,

$$\text{Therefore, } y = \frac{CE - BF}{AF - CD}$$

Let this value of y be put equal to the former value, thus we have $\frac{AF - CD}{BD - AE} = \frac{CE - BF}{AF - CD}$

And therefore $(AF - CD)^2 = (BD - AE)(CE - BF)$.

Now as y does not enter this equation, if we restore the values of A, B, C , &c. we have the following equation which involves only x , and known quantities.

$(b^2 + 2ax - 3x^2)^2 = (a + b - 3x)(bx^2 - (a - 3x)(2ax - 4x^2 + b^2))$; this equation when properly reduced will be of the fourth order, and therefore its final resolution belongs not to this place.

SECT. VIII. Questions producing Simple Equations.

133. WHEN a problem is proposed to be resolved by the algebraic method of analysis, its true meaning ought in the first place to be perfectly understood, so that, if necessary, it may be freed from all superfluous and ambiguous expressions; and its conditions exhibited in the clearest point of view possible. The several quantities concerned in the problem are next to be denoted by proper symbols, and their relation to one another expressed agreeably to the algebraic notation.

Thus

Thus we shall obtain a series of equations, which, if the question be properly limited, will enable us to determine all the unknown quantities required by the rules already delivered in the two preceding sections.

134. In reducing the conditions of a problem to equations, the following rule will be of service. Suppose that the quantities to be determined are actually found, and then consider by what operations the truth of the solution may be verified; then, let the same operations be performed upon the quantities, whether known or unknown, and thus all the conditions of the problem will be reduced to a series of equations, such as is required. For example; suppose that it is required to find two numbers, such, that their sum is 20, and the quotient arising from the division of their difference by the lesser 3; then if we denote the greater of the two numbers by x , and the lesser by y , and proceed as if to prove the truth of the solution, we shall have $x+y$ for the sum of the numbers, and $x-y$ for their difference. Now as the former must be equal to 20, and the latter divided by y equal to 3; the first condition of the problem will be expressed by this

equation $x+y=20$, and the second by $\frac{x-y}{y}=3$, and

from these the values of x and y may easily be found.

135. When the conditions of a problem have been expressed by equations, or as it were translated from the common language into that of algebra, we must next consider, whether the problem be properly limited; for, in some cases, the conditions may be such as to admit of innumerable solutions; and in others, they may involve an absurdity; and thus render the problem altogether impossible.

136. Now by considering the examples of last section, it will readily appear, that to determine any number of unknown quantities, there must be given as many equations as there are unknown quantities. These equations, however, must be such as cannot be derived from each other; and they must not involve any contradiction; for, in the one case, the problem would admit of an unlimited number of answers; and in the other case, it would be impossible. For example, if it were required to determine x and y from these two equations, $2x-3y=13$, $4x-6y=26$; as the latter equation is a consequence of the former (for each term of the one is the half of the corresponding term of the other) it is evident, that innumerable values of x and y might be found to satisfy both equations. Again, if x and y were to be determined from these equations, $x+2y=8$, $3x+6y=26$, it will quickly appear, that it is impossible to find such values of x and y , as will satisfy both equations: for, from the first of them, we find $3x=24-6y$; and from the second, $3x=26-6y$; and therefore $24-6y=26-6y$, or $24=26$, which is absurd; and so also must have been the conditions from which this conclusion is drawn.

137. But there is yet another case in which a problem may be impossible; and that is, when there are more equations than unknown quantities; for it appears, that in this case, by the rules of last section, we would at last find two equations, each involving the same unknown quantity. Now unless these equations happened to agree, the problem would admit of no solution. Upon the whole, therefore, it appears,

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that a problem is limited, when the conditions afford just as many independent equations as there are unknown quantities to be determined; if there be fewer equations the problem is indeterminate; but if there be more, the problem in general admits of no solution whatever.

138. In expressing the conditions of a problem by equations, it will, in general, be convenient to introduce as few symbols of unknown quantities as possible. Therefore, if two quantities be sought and their sum be given, suppose it $=s$, then if the one quantity be represented by x , the other may be denoted by $s-x$. If again their difference be given $=d$, the quantities may be denoted by x , and $d+x$, or by x , and $x-d$. If their product be given $=p$, the quantities are x , and $\frac{p}{x}$; and so on.

139. We shall now apply the preceding observations to some examples, which are so chosen as to admit of being resolved by simple equations.

Ex. 1. What is that number, to which if there be added its half, its third, and its fourth part, the sum will be 50?

Let x denote the number sought. Then its half will be $\frac{x}{2}$, its third $\frac{x}{3}$, and its fourth $\frac{x}{4}$.

Therefore $x + \frac{x}{2} + \frac{x}{3} + \frac{x}{4} = 50$.

Hence we find $24x + 12x + 8x + 6x = 1200$.

Or $50x = 1200$.

Therefore $x = 24$.

Thus it appears that the number sought is 24, which upon trial will be found to answer the conditions of the question.

Ex. 2. A post is $\frac{2}{3}$ of its length in the mud, $\frac{1}{3}$ in the water, and 10 feet above the water, what is its whole length?

Let its length be x feet, then the part in the mud is $\frac{2x}{3}$, and that in the water $\frac{x}{3}$; therefore, from the nature of the question,

$$\frac{2x}{3} + \frac{x}{3} + 10 = x.$$

From which equation we find $7x + 120 = 12x$, and $x = 24$.

Ex. 3. Two travellers set out at the same time from London and York, whose distance is 150 miles; one of them goes 8 miles a-day, and the other 7; in what time will they meet?

Suppose that they meet after x days.

Then the one traveller has gone $8x$ miles, and the other $7x$ miles; now the sum of the distances they travel is, by the question, equal to the distance from London to York.

Therefore $8x + 7x = 150$

$15x = 150$, and $x = 10$ days.

Ex. 4. A labourer engaged to serve for 40 days, upon these conditions; that for every day he worked he was to receive 20d. but for every day he played, or was absent, he was to forfeit 8d.; now at the end

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of

Simple Equations. of the time he had to receive 1l. 11s. 8d. It is required to find how many days he worked, and how many days he was idle.

Let x be the number of days he worked.
Then will $40 - x$ be the number of days he was idle.
Also $20 \times x = 20x$ = the sum he earned in pence.
And $8 \times (40 - x) = 320 - 8x$ = the sum he forfeited.
Now the difference of these two was 1l. 11s. 8d. or 380d.

Therefore $20x - (320 - 8x) = 380$,

That is $28x = 700$.

Hence $x = 25$ = the number of days he worked,

And $40 - x = 15$ = the number of days he was idle.

Ex. 5. A market-woman bought a certain number of eggs at 2 a-penny, and as many at 3 a-penny; and sold them all out again at 5 for 2d.: but, instead of getting her own money for them, as she expected, she lost 4d.: what number of eggs did she buy?

Let x be the number of eggs of each sort.

Then will $\frac{x}{2}$ be the price of the first sort.

And $\frac{x}{3}$ = the price of the second sort.

Now the whole number being $2x$, we have

$5 : 2x :: 2 : \frac{4x}{5}$ = price of both sorts at 5 for 2d.

Therefore $\frac{x}{2} + \frac{x}{3} - \frac{4x}{5} = 4$, by the question.

Hence $15x + 10x - 24x = 120$,

And $x = 120$, the number of each sort.

Ex. 6. A bill of 120l. was paid in guineas and moidores: the number of pieces of both sorts that were used was 100; how many were there of each?

Let the number of guineas be x .

Then the number of moidores will be $100 - x$.

Also the value of the guineas, reckoned in shillings, will be $21x$; and that of the moidores $27(100 - x) = 2700 - 27x$.

Therefore, by the question, $21x + 2700 - 27x = 2400$.

Hence we find $6x = 300$, and $x = 50$.

So that the number of pieces of each sort was 50.

Ex. 7. A footman agreed to serve his master for 8l. a-year, and livery; but was turned away at the end of 7 months, and received only 2l. 13s. 4d. and his livery; what was its value?

Suppose x the value of the livery, in pence.

Then his wages for a year were to be $x + 1920$ pence.

But for 7 months he received $x + 640$ pence.

Now he was paid in proportion to the time he served.

Therefore $12 : 7 :: x + 1920 : x + 640$.

And taking the product of the extremes and means,

$$12x + 7680 = 7x + 13440.$$

Hence $5x = 5760$, and $x = 1152$ = 4l. 16s.

Ex. 8. A person at play lost $\frac{1}{2}$ of his money, and then won 3s.; after which he lost $\frac{1}{3}$ of what he then had, and then won 2s.; lastly, he lost $\frac{1}{4}$ of what he then had; and, this done, found he had only 12s. left: what had he at first?

Suppose he began play with x shillings.

He lost $\frac{1}{2}$ of his money, or $\frac{x}{2}$, and had left $x - \frac{x}{2}$ = $\frac{3x}{2}$.

He won 3s. and had then $\frac{3x}{2} + 3 = \frac{3x + 12}{2}$.

He lost $\frac{1}{3}$ of $\frac{3x + 12}{2}$, or $\frac{x + 4}{2}$, and had left $\frac{3x + 12}{4}$.

He won 2s. and had then $\frac{3x + 12}{4} + 2 = \frac{3x + 16}{4}$.

He lost $\frac{1}{4}$ of $\frac{3x + 16}{4}$ or $\frac{3x + 16}{16}$, and had left $\frac{3x + 16}{4}$.

And because he had now 12s. left, we have this equation $\frac{3x + 16}{4} = 12$.

Hence $3x = 240$, and $x = 80$.

Ex. 9. Two tradesmen, A and B, are employed upon a piece of work; A can perform it alone in 15 hours, and B in 10 hours: in what time will they do it when working together?

Suppose that they can do it in x hours, and let the whole work be denoted by 1.

Then $15 : x :: 1 : \frac{x}{15}$ = the part of the work done by A.

And $10 : x :: 1 : \frac{x}{10}$ = the part done by B.

Now, by the question, they are to perform the whole work between them;

Therefore, $\frac{x}{15} + \frac{x}{10} = 1$.

Hence $25x = 150$, and $x = 6$ hours.

Ex. 10. The sum of any two quantities being given = s , and their difference = d , it is required to find each of the quantities.

Let x denote the greater of the two quantities, and y the lesser.

Then $x + y = s$, and $x - y = d$.

Taking the sum of the equations we get $2x = s + d$,

And subtracting the second from the first, $2y = s - d$;

Therefore $x = \frac{s + d}{2}$, and $y = \frac{s - d}{2}$.

Ex. 11. A gentleman distributing money among some poor people, found he wanted 10s. to be able to give each 5s.; therefore he gave only 4s. to each, and had 5s. left. Required the number of shillings and poor people.

Let the number of shillings be x , and that of the poor people y ; then, from the nature of the question, we have these two equations,

$$5y = x + 10 \quad 4y = x - 5.$$

From the first equation, $x = 5y - 10$,

And from the second, $x = 4y + 5$;

Therefore $5y - 10 = 4y + 5$.

Hence $y = 15$, and $x = 4y + 5 = 65$.

Ex. 12.

Ex. 12. A farmer kept a servant for every 40 acres of ground he rented, and on taking a lease of 104 more acres, he engaged 5 additional servants, after which he had a servant for every 36 acres. Required the number of servants and acres.

Suppose that he had at first x servants, and y acres.

From the first condition of the question $x = \frac{y}{40}$.

And from the second $x + 5 = \frac{y + 104}{36}$.

By comparing the values of x , as found from these equations, we have $\frac{y + 104}{36} - 5 = \frac{y}{40}$.

Hence $40y + 4160 - 7200 = 36y$, so that $4y = 3040$.

Therefore $y = 760$, and $x = \frac{y}{40} = 19$.

Ex. 13. Two persons, A and B, were talking of their ages; says A to B, seven years ago I was just three times as old as you were then, and seven years hence I shall be just twice as old as you will be. What is their present ages?

Let the ages of A and B be x and y respectively. Their ages seven years ago were $x - 7$ and $y - 7$, and seven years hence they will be $x + 7$ and $y + 7$.

Therefore by the question

$$x - 7 = 3(y - 7) \text{ and } x + 7 = 2(y + 7).$$

From the first equation, $x = 3y - 14$,

And from the second $x = 2y + 7$.

Therefore $3y - 14 = 2y + 7$; hence $y = 21$.

And because $x = 2y + 7$, therefore $x = 49$.

Ex. 14. A hare is 50 leaps before a greyhound, and takes 4 leaps to the greyhound's 3, but 2 of the greyhound's leaps are as much as 3 of the hare's. How many leaps must the greyhound take to catch the hare?

In this example there is only one quantity required, it will, however, be convenient to make use of two letters; therefore let x denote the number of leaps of the greyhound and y those of the hare; then, by considering the proportion between the number of leaps each takes in the same time, we have

$$3 : 4 :: x : y, \text{ hence } 3y = 4x.$$

Again, by considering the proportion between the number of leaps each must take to run the same distance, we find $x : 50 + y :: 2 : 3$, hence $100 + 2y = 3x$.

From the first equation we find $6y = 8x$.

And from the second $6y = 9x - 300$.

Hence $9x - 300 = 8x$, and $x = 300$.

Ex. 15. To divide the number 90 into 4 such parts, that if the first be increased by 2, the second diminished by 2, the third multiplied by 2, and the fourth divided by 2; the sum, difference, product, and quotient, shall be all equal to each other.

In this question there are four quantities to be determined; but instead of introducing several letters, having put x to denote the first of them, we may find an expression for each of the remaining ones, as follows:

Because $x + 2 = \text{second quantity} - 2$.

Therefore $x + 4 = \text{the second quantity}$.

And because $x + 2 = \text{third} \times 2$,

Therefore $\frac{x + 2}{2} = \text{the third quantity}$.

And in like manner $2(x + 2) = \text{the fourth quantity}$.
Now by the question, the sum of all the four = 90.

$$\text{Therefore } x + x + 4 + \frac{x + 2}{2} + 2(x + 2) = 90;$$

Hence $9x = 162$, and $x = 18$.

Therefore the numbers required are 18, 22, 10, and 40.

Ex. 16. A and B together can perform a piece of work in 12 hours, A and C in 20, and B and C in 15 hours; in what time will each be able to perform it when working separately?

That we may have a general solution, let us suppose A and B can perform the work in a hours, A and C in b hours, and B and C in c hours. Let x , y , and z , denote the times in which A, B, and C, could perform it respectively, if each wrought alone; and let the whole work be represented by 1.

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Then $x : a :: 1 : \frac{a}{x} = \text{the part done by A}$ } in a hours.
 $y : a :: 1 : \frac{a}{y} = \text{the part done by B}$

Also $x : b :: 1 : \frac{b}{x} = \text{the part done by A}$ } in b hours.
 $z : b :: 1 : \frac{b}{z} = \text{the part done by C}$

And $y : c :: 1 : \frac{c}{y} = \text{the part done by B}$ } in c hours.
 $z : c :: 1 : \frac{c}{z} = \text{the part done by C}$

Now by the question we have the three following equations.

$$\frac{a}{x} + \frac{a}{y} = 1, \quad \frac{b}{x} + \frac{b}{z} = 1, \quad \frac{c}{y} + \frac{c}{z} = 1.$$

Let the first equation be divided by a , the second by b , and the third by c , thus we have

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{a}, \quad \frac{1}{x} + \frac{1}{z} = \frac{1}{b}, \quad \frac{1}{y} + \frac{1}{z} = \frac{1}{c}.$$

If these be added together, and their sum divided by 2, we find

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{1}{2a} + \frac{1}{2b} + \frac{1}{2c}.$$

From this equation let each of the three last be subtracted in its turn; thus we get

$$\frac{1}{x} = -\frac{1}{2a} + \frac{1}{2b} + \frac{1}{2c} = \frac{+ab + ac - bc}{2abc}$$

$$\frac{1}{y} = \frac{1}{2a} - \frac{1}{2b} + \frac{1}{2c} = \frac{abc - ac + bc}{2abc}$$

$$\frac{1}{z} = \frac{1}{2a} + \frac{1}{2b} - \frac{1}{2c} = \frac{-ab + ac + bc}{2abc}$$

$$\text{Hence } x = \frac{2abc}{+ab + ac - bc} = \frac{7200}{120} = 60$$

$$y = \frac{2abc}{+ab - ac + bc} = \frac{7200}{360} = 20$$

$$z = \frac{2abc}{-ab + ac + bc} = \frac{7200}{240} = 30.$$

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SECT.

SECT. IX. Of Quadratic Equations.

140. WE are next to explain the manner of resolving equations of the second degree, or quadratic equations. These involve the second power of the unknown quantity, as has been already observed (§ 113.), and may be divided into two kinds, *pure* and *adfect*ed.

141. I. *Pure* quadratic equations are such as after proper reduction have the square of the unknown quantity in one term, while the remaining terms contain only known quantities. Thus, $x^2=64$, and $ax^2+b=c$, are examples of pure quadratics.

142. II. *Adfect*ed quadratic equations, contain the square of the unknown quantity in one term, and its first or simple power in another, and the remaining terms consist entirely of known quantities. Such are the following, $x^2+3x=28$, $2x^2=33-5x$, $ax^2+bx-c=d$.

143. The manner of resolving a pure quadratic equation is sufficiently evident; if the unknown quantity be made to stand alone on one side, with unity as a coefficient, while the other side consists entirely of known quantities, and if the square root of each side be taken, we shall immediately obtain the value of the simple power of the unknown quantity as already directed by Rule 5th of Sect. VI.

144. In extracting the square root of any quantity, however, it is necessary to observe, that the sign of the root may be either $+$ or $-$. This is an evident consequence of the rule for the signs in multiplication; for since by that rule any quantity, whether positive or negative, if multiplied by itself, will produce a positive quantity, and therefore the square of $+a$, as well as that of $-a$ is $+a^2$; so, on the contrary, the square root of $+a^2$ is to be considered either as $+a$ or as $-a$, and may accordingly be expressed thus $\pm a$.

145. Having remarked that the square of any quantity, whatever be its sign, is always positive; it evidently follows, that no real quantity whatever, when multiplied by itself, can produce a negative quantity; and therefore if the square root of a negative quantity be required, no such root can be assigned. Hence it also follows, that if a problem requires for its solution the extraction of the square root of a negative quantity, some contradiction must necessarily be involved, either in the condition of the problem, or in the process of reasoning by which that solution has been obtained.

146. When an *adfect*ed quadratic equation is to be resolved, it may always, by proper reduction, be brought to one or other of the three following forms:

1. $x^2+px=q$
2. $x^2-px=q$
3. $x^2-px=-q$.

But as the manner of resolving each of the three forms is the very same, it will be sufficient if we consider any one of them.

147. Resuming therefore the first equation, or $x^2+px=q$; let us compare the side of it which involves the unknown quantity x with the square of a binomial $x+a$; that is, let us compare x^2+px with $x^2+2ax+a^2=(x+a)^2$; and it will presently appear, that if we

suppose $p=2a$, or $\frac{p}{2}=a$, the quantities x^2+px and x^2+2ax will be equal; and as x^2+2ax is rendered a complete square, by adding to it a^2 , so also may x^2+px be completed into a square, by adding to it $\frac{p^2}{4}$, which is

equal to a^2 ; therefore, let $\frac{p^2}{4}$ be added to both sides of the equation $x^2+px=q$, and we have

$$x^2+px+\frac{p^2}{4}=\frac{p^2}{4}+q, \text{ or } \left(x+\frac{p}{2}\right)^2=\frac{p^2}{4}+q;$$

and extracting the square root of each side, $x+\frac{p}{2}=$

$$\pm\sqrt{\frac{p^2}{4}+q}; \text{ hence } x=-\frac{p}{2}\pm\sqrt{\frac{p^2}{4}+q}.$$

148. From these observations we derive the following general rule for resolving *adfect*ive quadratic equations.

1. Transpose all the terms involving the unknown quantity to one side, and the known quantities to the other side, and so that the term involving the square of the unknown quantity may be positive.

2. If the square of the unknown quantity be multiplied by a coefficient, let the other terms be divided by it, so that the coefficient of the square of the unknown quantity may be 1.

3. Add to both sides the square of half the coefficient of the unknown quantity itself, and the side of the equation involving the unknown quantity will now be a complete square.

4. Extract the square root of both sides of the equation, by which it becomes simple with respect to the unknown quantity; and by transposition, that quantity may be made to stand alone on one side of the equation while the other side consists of known quantities; and therefore the equation is resolved.

Note. The square root of the first side of the equation is always equal to the sum, or difference, of the unknown quantity, and half the coefficient of the second term. If the sine of that term be $+$, it is equal to the sum, but if it be $-$, then it is equal to the difference.

Ex. 1. Given $x^2+2x=35$, to determine x .

Here the coefficient of the second term is 2, therefore adding the square of its half to each side, we have

$$x^2+2x+1=35+1=36$$

And extracting the square root $x+1=\sqrt{36}=\pm 6$.

Hence $x=\pm 6-1$, that is $x=+5$, or $x=-7$, and either of these numbers will be found to satisfy the equation, for $5 \times 5 + 2 \times 5 = 35$, also $-7 \times -7 + 2 \times -7 = 35$.

Ex. 2. Given $\frac{x^2}{6}-12=x$, to find x .

This equation, when reduced, becomes $x^2-6x=72$.

And by completing the square, $x^2-6x+9=72+9=81$.

Hence by extracting the square root, $x-3=\pm 9$.

And $x=\pm 9+3$, therefore $x=+12$, or $x=-6$, and upon trial we find that each of these values satisfies

Quadratic Equations. satisfies the original equation, for $\frac{12 \times 12}{6} - 12 = 12$, also

$$-\frac{6 \times -6}{6} - 12 = -6.$$

Ex. 3. Given $x^2 + 28 = 11x$, to find x .

Then $x^2 - 11x = -28$.

$$\text{And, completing the square, } x^2 - 11x + \frac{121}{4} = \frac{121}{4} - 28 = \frac{9}{4}.$$

Therefore, by extracting the root, $x - \frac{11}{2} = \pm \frac{3}{2}$.

Hence $x = \frac{11}{2} \pm \frac{3}{2}$, that is, $x = +7$, or $x = +4$.

In the first two examples, we found one positive value for x in each, and also one negative value; but in this example both the values of x are positive, and, upon trial, each of them is found to satisfy the equation; for $7 \times 7 + 28 = 11 \times 7$, also $4 \times 4 + 28 = 11 \times 4$.

149. As at first sight it appears remarkable, that in every quadratic equation the unknown quantity admits always of two distinct values, or roots, it will be proper to consider a little farther the circumstances upon which this peculiarity depends. This is the more necessary, as the property of the unknown quantity admitting of several values is not peculiar to quadratics, but takes place also in equations of the higher degrees, where the cause of the ambiguity requires an explanation somewhat different from that which we have already given in the present case.

150. Let us again consider the equation $x^2 + 2x = 35$, which forms the first of the three preceding examples; by transposing all the terms to one side, the same equation may be also expressed thus, $x^2 + 2x - 35 = 0$; so that we shall have determined x , when we have found such a number, as when substituted for it in the quantity $x^2 + 2x - 35$, will render the result equal to 0. But $x^2 + 2x - 35$ is the product of these two factors $x - 5$, and $x + 7$, as may be proved by actual multiplication; therefore, to find x , we have $(x - 5)(x + 7) = 0$; and as a product can only become 0, when one of its factors is reduced to 0, it follows, that either of the two factors $x - 5$ and $x + 7$ may be assumed 0; if $x - 5 = 0$, then $x = 5$; but if $x + 7 = 0$, then $x = -7$, so that the two values of x , or two roots of the equation $x^2 + 2x = 35$ are $+5$ and -7 , as we have already found in a different manner.

151. What has been just now shewn in a particular case is true of any quadratic equation whatever, that is, if $x^2 + px = q$, or by bringing all the terms to one side, $x^2 + px - q = 0$, it is always possible to find two factors $x + a$, and $x - b$, such, that $x^2 + px - q = (x + a)(x - b)$, where a and b are known quantities, which depend only upon p and q the given numbers in the equation, and since that to have $(x - a)(x + b) = 0$, we may either assume $x - a = 0$, or $x + b = 0$, it evidently follows, that the conditions of the equation $x^2 + px - q = 0$, or $x^2 + px = q$ are alike satisfied, by taking $x = +a$ or $x = -b$.

From these considerations, it follows, that x can have only two values in a quadratic equation; for if it could be supposed to have three or more values,

then it would be possible to resolve $x^2 + px - q$ into as many factors, $x - c$, $x - d$, &c.; but the product of more than two factors must necessarily contain the third or higher powers of x ; and as $x^2 + px - q$ contains no higher power than the second; therefore no such resolution can take place.

152. Since it appears that $x^2 + px - q$ may be considered as the product of two factors $x - a$, and $x + b$; let us examine the nature of these factors; accordingly, taking their product by actual multiplication, we find it $x^2 + (b - a)x - ab$; and since this quantity must be equal to $x^2 + px - q$, it follows, that $b - a = p$ and $ab = q$, or, changing the signs of the terms of both equations, $a - b = -p$, $-ab = -q$. Now if we consider that $+a$, and $-b$, are the roots of the equation $x^2 + px = q$; it is evident that $a - b$ is the sum of the roots, and $-ab$ their product. So that from the equations $a - b = -p$, and $-ab = -q$, we derive the following proposition relating to the roots of any quadratic equation. The sum of the roots of any quadratic equation $x^2 + px = q$ is equal to $-p$, that is, to the coefficient of the second term, having its sign changed; and their product is equal to $-q$, or to the latter side of the equation, having its sign also changed.

153. This proposition enables us to resolve several important questions concerning the roots of a quadratic equation, without actually resolving that equation. Thus we learn from it, that if q , the term which does not involve the unknown quantity, (called sometimes the absolute number) be positive, the equation has one of its roots positive, and the other negative; but if that term be negative, the roots are either both positive or both negative. It also follows, that in the former case the root which is denoted by the least number will have the same sign with the second term, and in the latter case, the common sign of the roots will be the contrary to that of the second term.

154. From this property of the roots we may also derive a general solution to any quadratic equation $x^2 + px = q$; for we have only to determine two quantities whose sum is $-p$, and product $-q$, and whose quantities shall be the two values of x , or the two roots of the equation.

Without considering the signs of the roots, let us call them v and z , then

$$v + z = -p, \text{ and } vz = -q,$$

From the square of each side of the first equation let four times the second be subtracted, and we have

$$v^2 - 2vz + z^2 = p^2 + 4q \text{ or } (v - z)^2 = p^2 + 4q,$$

therefore by extracting the square root, $v - z = \pm \sqrt{p^2 + 4q}$; from this equation, and from the equation

$$v + z = -p, \text{ we readily obtain } v = \frac{-p \pm \sqrt{p^2 + 4q}}{2}.$$

$$z = \frac{-p \mp \sqrt{p^2 + 4q}}{2}, \text{ that is, if } v = \frac{-p + \sqrt{p^2 + 4q}}{2}$$

$$\text{then } z = \frac{-p - \sqrt{p^2 + 4q}}{2}, \text{ and if } v = \frac{-p - \sqrt{p^2 + 4q}}{2}$$

$$\text{then } z = \frac{-p + \sqrt{p^2 + 4q}}{2}.$$

But the value of v , upon the one supposition, is the same as the value of z upon the other supposition, and vice versa; therefore, in reality, the only two distinct values

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values of the roots v and x are $\frac{-p + \sqrt{p^2 + 4q}}{2}$ and

$$\frac{-p - \sqrt{p^2 + 4q}}{2}, \text{ which agrees with the conclusion we}$$

have already found, (§ 148).

155. It appears from what has been already shewn, that the roots of a quadratic equation $x^2 + px = q$ always involve the quantity $\sqrt{p^2 + 4q}$; hence it follows, that $p^2 + 4q$ must be a positive quantity; for if it were negative, as the square root of such a quantity could not be found, the value of x could not possibly be obtained. If for example the value of x were required from this equation $x^2 + 13 = 4x$, or $x^2 - 4x = -13$, we should find $x = 2 \pm \sqrt{-9}$; and as this expression for the roots requires us to extract the square root of -9 , the equation from which it is derived must necessarily have involved some contradiction. It is not difficult to see wherein the absurdity consists, for since in this case $p = -4$, and $q = -13$, the roots of the equation ought to be both positive (§ 154), and such that their sum = 4, while their product = 13, (§ 153), which is impossible.

159. Although imaginary quantities serve no other purpose in the resolution of quadratic equations, than to shew that a particular problem cannot be resolved, by reason of some want of consistency in its data; yet they are not upon that account to be altogether rejected. By introducing them into mathematical investigations, many curious theories may be explained, and problems resolved in a more concise way, than can be done without the use of such quantities. This is particularly the case with respect to the higher parts of the mathematics.

157. The method which has been applied to the resolution of quadratic equations, properly so called, namely, such as are of this form, $x^2 + px = q$, will also apply to all equations of this form,

$$x^{2n} + px^n = q,$$

where the unknown quantity x is found only in two terms, and such, that its exponent in the one term is double that in the other; for let us assume $x^n = y$, then $x^{2n} = y^2$, and therefore the equation

$$y^2 + py = q \text{ becomes}$$

$$y^2 + py = q,$$

a quadratic equation, from which x may be found, and thence x , by considering that $x^n = \sqrt[n]{y}$.

158. Before proceeding to give examples of questions producing quadratic equations, it is proper to observe, that although every such equation admits of two roots; yet it will frequently happen, that only one of them can be of use, the other being excluded by the conditions of the question. This will often be the case with respect to the negative root; as, for example, when the unknown quantity denotes a number of men, a number of days, &c. And hence, in reckoning the cases of quadratic equations, it is common to neglect this one $x^2 + px = -q$, where the roots are both negative; for an equation of this form can only be derived from a question which has some fault in its enunciation, and which, by a proper change in its form, will produce another equation having both its roots positive.

159. The remainder of this section shall be employed in solving some questions which produce quadratic equations.

Ex. 1. It is required to divide the number 10 into two such parts, that the sum of their squares may be 58. Quadratic Equation

Let x be the one number.

Then, since their sum is 10, we have $10 - x$ for the other.

$$\text{And by the question } x^2 + (10 - x)^2 = 58$$

$$\text{That is } x^2 + 100 - 20x + x^2 = 58$$

$$\text{Or } 2x^2 - 20x = 58 - 100 = -42$$

$$\text{Hence } x^2 - 10x = -21$$

$$\text{And completing the square } x^2 - 10x + 25 = 25 - 21 = 4$$

$$\text{Hence, by extracting the root, } x - 5 = \pm \sqrt{4} = \pm 2.$$

$$\text{And } x = 5 \pm 2 = 7$$

$$\text{That is } x = 7 \text{ or } x = 3.$$

If we take the greatest value of x , viz. 7, then the other number $10 - x$ will be 3; and if we take the least value of x , viz. 3, then the other number is 7. Thus it appears, that the greatest value of the one number corresponds to the least value of the other; and indeed this must necessarily be the case, seeing that both numbers are alike concerned in the question. Hence, upon the whole, the only numbers that will answer the conditions of the question are 7 and 3.

Ex. 2. What two numbers are those whose product is 28; and such, that twice the greater, together with thrice the lesser, is equal to 26.

Let x be the greatest and y the least number, then, from the nature of the question, we have these two equations,

$$xy = 28, \quad 2x + 3y = 26.$$

$$\text{From the first equation we have } y = \frac{28}{x}.$$

$$\text{And from the second } y = \frac{26 - 2x}{3}.$$

$$\text{Hence, } \frac{26 - 2x}{3} = \frac{28}{x}.$$

$$\text{And, reducing, } 26x - 2x^2 = 84$$

$$\text{Or } 2x^2 - 26x = -84$$

$$\text{Hence } x^2 - 13x = -42$$

$$\text{And comp. the sq. } x^2 - 13x + \frac{169}{4} = \frac{169}{4} - 42\frac{1}{2}$$

$$\text{Hence, by extracting the root } x - \frac{13}{2} = \pm \sqrt{\frac{1}{4}} = \pm \frac{1}{2}$$

$$\text{Therefore } x = \frac{13}{2} \pm \frac{1}{2}$$

$$\text{That is } x = 7, \text{ or } x = 6.$$

$$\text{And since } y = \frac{28}{x}, \text{ we have } y = 4, \text{ or } y = \frac{14}{3}.$$

Thus we have obtained two sets of numbers, which fulfil the conditions required, viz.

$$x = 7, y = 4 : \text{ Or } x = 6, y = \frac{14}{3}.$$

And besides these, there can be no other numbers.

Ex. 3. A company dining together at an inn, find their bill amount to 175 shillings; two of them were not allowed to pay, and the rest found, that their shares amounted to 10 shillings a-man more than if they had all paid. How many were in company?

Suppose their number to be x .

Then, if all had paid, the share of each would have been $\frac{175}{x}$.

But

But, because only $x-2$ paid, the share of each was $\frac{175}{x-2}$.

Therefore, by the question, $\frac{175}{x-2} - \frac{175}{x} = 10$.

And by proper reduction $175x - 175x + 350 = 10x^2 - 20x$.

That is $10x^2 - 20x = 350$

Or $x^2 - 2x = 35$

And comp. the sq. $x^2 - 2x + 1 = 35 + 1 = 36$

Hence, by extracting the root, $x^2 + 1 = \pm 6$.

Therefore, $x = +5$, or $x = -7$. But from the nature of the question, the negative root can be of no use; therefore $x = 6$.

Ex. 4. A mercer sold a piece of cloth for 24l. and gained as much per cent. as the cloth cost him; what was the price of the cloth?

Suppose that it cost x pounds,

Then the gain was $24 - x$,

And by the question $100 : x :: x : 24 - x$,

Therefore, taking the product of the extremes and means, $2400 - 100x = x^2$,

Or $x^2 + 100x = 2400$,

And comp. the sq. $x^2 + 100x + 2500 = 4900$,

Hence, taking the root, $x + 50 = \pm 70$,

And $x = +20$ or -120 .

Here, as in the last question, the negative root cannot apply; therefore $x = 20$ pounds, the price required.

Ex. 5. A grazier bought as many sheep as cost him 60l. out of which he reserved 15, and sold the remainder for 54l. and gained 2s. each upon them. How many sheep did he buy, and what did each cost him?

Suppose that he bought x sheep,

Then each would cost him $\frac{1200}{x}$ shillings.

Therefore, after reserving 15, he sold each of the remaining $x - 15$ for $\frac{1200}{x} + 2$ shillings.

Hence he would receive for them $(x - 15)(\frac{1200}{x} + 2)$ shillings. And, because 54l. = 1080 shillings, we have

by the question $(x - 15)(\frac{1200}{x} + 2) = 1080$.

Which by proper reduction becomes $x^2 + 45x = 9000$.

Or, completing the square, $x^2 + 45x + \frac{2025}{4} = \frac{38025}{4}$.

Therefore, extracting the root, &c. $x = \pm \frac{195}{2} - \frac{45}{2}$.

And taking the positive root, $x = 75$, the number of sheep; and consequently $\frac{1200}{75} = 16$ shillings the price of each.

Ex. 6. What number is that, which, when divided by the product of its two digits, the quotient is 3; and if 18 be added to it, the digits are inverted. Let x and y denote the digits; then the number itself will be expressed by $10x + y$; and that number, in which the digits are inverted, by $10y + x$. Thus the conditions of the problem will be expressed by these two equations,

$$\frac{10x + y}{xy} = 3, 10x + y + 18 = 10y + x.$$

From the first equation we have $y = \frac{10x}{3x - 1}$,

And from the second $y = x + 2$;

Therefore $x + 2 = \frac{10x}{3x - 1}$,

And $3x^2 + 5x - 2 = 10x$.

Hence $x^2 - \frac{5}{3}x = \frac{2}{3}$,

And comp. sq. $x^2 - \frac{5}{3}x + \frac{25}{36} = \frac{2}{3} + \frac{25}{36} = \frac{49}{36}$;

Therefore, taking the root $x - \frac{5}{6} = \pm \frac{7}{6}$,

So that $x = 2$, or $x = -\frac{1}{3}$.

Here it is evident that the negative root is useless; hence we have $y = x + 2 = 4$, and 24 for the number required.

Ex. 7. It is required to find two numbers whose product is 100; and the difference of their square roots 3.

Let x be the one number; then $\frac{100}{x}$ must denote the other.

Now by the question $\sqrt{\frac{100}{x}} - \sqrt{x} = 3$;

Hence we have $10 - x = 3\sqrt{x} = 3x^{\frac{1}{2}}$,

Or $x + 3x^{\frac{1}{2}} = 10$,

And comp. the sq. $x + 3x^{\frac{1}{2}} + \frac{9}{4} = 10 + \frac{9}{4} = \frac{49}{4}$,

and taking the root $x^{\frac{1}{2}} + \frac{3}{2} = \pm \frac{7}{2}$;

So that $x^{\frac{1}{2}} = +5$ or $x^{\frac{1}{2}} = -2$,

and therefore $x = 25$ or $x = 4$.

If $x = 4$, the other number is $\frac{100}{4} = 25$, and if $x = 25$, then the other number is 4; so that, in either case, the two numbers which answer the conditions of the question are 4 and 25.

Ex. 8. It is required to find two numbers, of which the product shall be 6, and the sum of their cubes 35.

Let v be the one number, then $\frac{6}{v}$ will be the other.

Therefore, by the question, $v^3 + \frac{216}{v^3} = 35$;

Hence $v^6 + 216 = 35v^3$,

Or $v^6 - 35v^3 = -216$.

This equation, by putting $v^3 = y$, becomes

$$y^2 - 35y = -216;$$

Hence we find $y = 27$, or $y = 8$.

And since $v^3 = y$; therefore $v = 3$, or $v = 2$.

If $v = 3$, then the other number is 2, and if $v = 2$, the other number is 3; so that 2 and 3 are the numbers required.

In general, if it be required to find two numbers, which are exactly alike concerned in a question that produces a quadratic equation; the two numbers sought will be the roots of that equation. A similar observation applies to any number of quantities which require for the determination the resolution of an equation of any degree whatever.

SECT. X. Of Equations in General.

160. BEFORE we proceed to the resolution of cubics, and the higher orders of equations, it will be proper

Equations to explain some general properties, which belong to
in general. equations of every degree; and also certain operations,
which must frequently be performed upon equations,
before they be fitted for a final solution.

161. In treating of equations in general, we shall suppose all the terms transposed to one side, and put equal to 0; this we have already done in explaining the nature of quadratics, and in like manner an equation of the fourth degree will stand thus:

$$x^4 + px^3 + qx^2 + rx + s = 0,$$

where x denotes an unknown quantity, and p, q, r, s , known quantities, either positive or negative. In this equation the coefficient of the highest power of x is unity, but if it had been any other quantity, that quantity might have been taken away, and the equation reduced to the above form, by rules already explained, Sect. VI.

162. The terms of an equation being thus arranged, if such a quantity be found, as when substituted for x , will render both sides = 0, and therefore satisfy the equation, that quantity, whether it be positive or negative or even imaginary, is to be considered as a root of the equation. But we have seen that every quadratic equation has always two roots, real or imaginary, we may therefore suppose that a similar diversity of roots will take place in all equations of a higher degree; and this supposition we shall presently find to be well founded, by means of the following proposition, which is of great importance in the theory of equations.

If a root of any equation, as $x^4 + px^3 + qx^2 + rx + s = 0$, be represented by a , the first side of that equation is divisible by $x - a$.

For since $x^4 + px^3 + qx^2 + rx + s = 0$,

And also $a^4 + pa^3 + qa^2 + ra + s = 0$;

Therefore, by subtraction, $x^4 - a^4 + p(x^3 - a^3) + q(x^2 - a^2) + r(x - a) = 0$.

163. But any quantity of this form $x^n - a^n$, where n denotes a whole positive number, is equal to

$$(x - a)(x^{n-1} + ax^{n-2} + a^2x^{n-3} + \dots + a^{n-2}x + a^{n-1}),$$

as may be easily proved by multiplication; therefore, putting $n = 4, 3$ and 2 successively, we have

$$x^4 - a^4 = (x - a)(x^3 + ax^2 + a^2x + a^3)$$

$$x^3 - a^3 = (x - a)(x^2 + ax + a^2)$$

$$x^2 - a^2 = (x - a)(x + a)$$

$$x - a = (x - a)$$

and by substitution, and collecting into one term the coefficients of the like powers of x , the equation

$x^4 - a^4 + p(x^3 - a^3) + q(x^2 - a^2) + r(x - a) = 0$ becomes $(x - a)[x^3 + (a + p)x^2 + (a^2 + pa + q)x + a^3 + pa^2 + qa + r] = 0$, so that putting $p' = a + p$, $q' = a^2 + pa + q$, $r' = a^3 + pa^2 + qa + r$, we have

$$x^4 + px^3 + qx^2 + rx + s = (x - a)(x^3 + p'x^2 + q'x + r').$$

Hence, if the proposed equation $x^4 + px^3 + qx^2 + rx + s = 0$ be divided by $x - a$, the quotient will be $x^3 + p'x^2 + q'x + r'$, an integer quantity, and since the same mode of reasoning will apply to any equation whatever, the truth of the proposition is evident.

164. We have found that $(x - a)(x^3 + p'x^2 + q'x + r') = 0$, and as a product becomes = 0, when any one of its factors = 0, therefore, the equation will have

its conditions fulfilled, not only when $x - a = 0$, but also when $x^3 + p'x^2 + q'x + r' = 0$.

Let us now suppose that b is a root of this equation, then by reasoning exactly as in last article, and putting $p'' = b + p'$, $q'' = b^2 + p'b + q'$, we shall have

$$x^3 + p'x^2 + q'x + r' = (x - b)(x^2 + p''x + q'') = 0,$$

and therefore

$$x^4 + px^3 + qx^2 + rx + s = (x - a)(x - b)(x^2 + p''x + q'').$$

165. By proceeding in the same manner with the quadratic equation $x^2 + p''x + q'' = 0$, we shall find that if c denote one of its roots, then

$$x^2 + p''x + q'' = (x - c)(x + c + p'').$$

So that if we put $d = -(c + p'')$, we at last find $x^4 + px^3 + qx^2 + rx + s = (x - a)(x - b)(x - c)(x - d)$; and since each of the factors $x - a$, $x - b$, $x - c$, $x - d$ may be assumed = 0, it follows, that there are four different values of x , which will render the equation $x^4 + px^3 + qx^2 + rx + s = 0$, namely, $x = a$, $x = b$, $x = c$, $x = d$.

166. The mode of reasoning which has been just now employed in a particular case, may be applied to an equation of any order whatever; we may therefore conclude, that every equation may be considered as the product of as many simple factors, as the number denoting its order contains unity; and therefore, that the number of roots in any equation is precisely equal to the exponent of the highest power of the unknown quantity contained in that equation.

167. By considering equations of all degrees as formed from the product of factors $x - a$, $x - b$, $x - c$, &c. we discover a number of curious relations, which subsist between the roots of any equation whatever, and its coefficients. Thus, if we limit the number of factors to four, and suppose that a, b, c, d , are the roots of this equation of the fourth degree

$$x^4 + px^3 + qx^2 + rx + s = 0,$$

we shall also have $(x - a)(x - b)(x - c)(x - d) = 0$; and therefore, by actual multiplication,

$$\left. \begin{array}{l} x^4 - a^4 \\ -b^4 \\ -c^4 \\ -d^4 \end{array} \right\} x^3 \left. \begin{array}{l} +ab \\ +ac \\ +ad \\ +bc \\ +bd \\ +cd \end{array} \right\} x^2 \left. \begin{array}{l} -abc \\ -abd \\ -acd \\ -bcd \end{array} \right\} x + abcd = 0.$$

168. If we compare together the coefficients of the same powers of x , we find the following series of equations:

$$\begin{aligned} a + b + c + d &= -p \\ ab + ac + ad + bc + bd + cd &= +q \\ abc + abd + acd + bcd &= -r \\ abcd &= +s; \end{aligned}$$

and as a similar series of equations will be obtained for every equation whatever, we hence derive the following propositions, which are of the greatest importance in the theory of equations.

1. The coefficient of the second term of any equation taken with a contrary sign, is equal to the sum of all the roots.

2. The coefficient of the third term is equal to the sum of the products of the roots multiplied together two and two.

3. The coefficient of the fourth term, taken with a contrary

contrary sign, is equal to the sum of the roots multiplied together three and three, and so on for the remaining coefficients, till we come to the last term of the equation, which is equal to the product of all the roots, having their signs changed.

169. Instead of supposing an equation to be produced by multiplying together simple equations, we may consider it as formed by the product of equations of any degree, provided that the sum of their dimensions is equal to that of the proposed equation. Thus, an equation of the fourth degree may be formed either from a simple and cubic equation, or from two quadratic equations.

170. If n denote the degree of an equation, we have shewn, that by considering it as the product of simple factors, that equation will have n divisors of the first degree; but if we suppose the simple factors to be combined two and two, they will form quantities of the second degree, which are also factors of the equation;

and since there may be formed $\frac{n(n-1)}{1 \cdot 2}$ such combinations, any equation will admit of $\frac{n(n-1)}{1 \cdot 2}$ divisors of the second degree.

171. For example, the equation $x^4 + px^3 + qx^2 + rx + s = 0$, which we have considered as equal to

$$(x-a)(x-b)(x-c)(x-d) = 0,$$

may be formed of the product of two factors of the second degree, in these six different ways.

By the product of $(x-a)(x-b)$ and $(x-c)(x-d)$

$(x-a)(x-c)$	$(x-b)(x-d)$
$(x-a)(x-d)$	$(x-b)(x-c)$
$(x-b)(x-c)$	$(x-a)(x-d)$
$(x-b)(x-d)$	$(x-a)(x-c)$
$(x-c)(x-d)$	$(x-a)(x-b)$

Thus an equation of the fourth degree may have $\frac{4 \times 3}{1 \times 2} = 6$ quadratic divisors.

172. By combining the simple factors three and three, we shall have divisors of the third degree, of which the number for an equation of the n th order will be $\frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3}$; and so on.

173. When the roots of an equation are all positive, its simple factors will have this form $x-a, x-b, x-c, \&c.$ and if for the sake of brevity we take only these three, the cubic equation which results from their product will have this form,

$$x^3 - px^2 + qx - r = 0,$$

$$\text{where } p = a+b+c, \quad q = ab+ac+bc, \quad r = abc,$$

and here it appears that the signs of the terms are + and - alternately.

Hence we infer, that when the roots of an equation are all positive, the signs of its terms are positive and negative alternately.

174. If again the roots of the equation be all negative, and therefore its factors $x+a, x+b, x+c$, then p, q , and r being as before, the resulting equation will stand thus:

$$x^3 + px^2 + qx + r = 0.$$

And hence we conclude, that when the roots are all negative, there is no change whatever in the signs.

175. In general, if the roots of an equation be all real, that equation will have as many positive roots as there are changes of the signs from + to -, or from - to +; and the remaining roots are negative. This rule, however, does not apply when the equation has imaginary roots, unless such roots be considered as either positive or negative.

176. That the rule is true when applied to quadratic equations will be evident from Sect. IX. With respect to cubic equations, the rule also applies when the roots are either all positive, or all negative, as we have just now shewn.

When a cubic equation has one positive root, and the other two negatives, its factors will be $x-a, x+b, x+c$, and the equation itself

$$\left. \begin{array}{l} x^3 - a \\ + b \\ + c \end{array} \right\} x^2 - \left. \begin{array}{l} ab \\ ac \\ bc \end{array} \right\} x - abc = 0.$$

Here there must always be one change of the signs, since the first term is positive, and the last negative; and there can be no more than one; for if the second term is negative, or $b+c$ less than a , then $(b+c)^2$ will be less than $(b+c)a$; but $(b+c)^2$ is always greater than bc , therefore bc will be much less than $(b+c)a$ or $ab+ac$, so that the third term must also be negative, and therefore in this case only one change of the signs. If again the second term be positive, then because the sign of the last term is negative, whatever be the sign of the third term, there can still be no more than one change of the signs.

When the equation has two positive roots and one negative, its factors are $x-a, x-b, x-c$, and the equation

$$\left. \begin{array}{l} x^3 - a \\ - b \\ + c \end{array} \right\} x^2 - \left. \begin{array}{l} ab \\ ac \\ bc \end{array} \right\} x + abc = 0.$$

Here there must always be two changes of the signs; for if $a+b$ be greater than c , the second term is negative, and the last term being always positive, there must be two changes, whether the sign of the third term be positive or negative. If again $a+b$ be less than c , and therefore the second term positive; it may be shewn as before, that ab is much less than $ac+bc$; and hence the third term will be negative; so that in either case there must be two changes of the signs. We may conclude, therefore, upon the whole, that in cubic equations there are always as many positive roots, as changes of the signs from + to -, or from - to +; and by the same method of reasoning, the rule will be found to extend to all equations whatever.

177. It appears from the manner in which the coefficients of an equation are formed from its roots, that when the roots are all real, the coefficients must consist entirely of real quantities. But it does not follow, on the contrary, that when the coefficients are real, the roots are also real; for we have already found, that in a quadratic equation, $x^2 + px + q = 0$, where p and q denote real quantities, the roots are sometimes both imaginary.

178. When the roots of a quadratic equation are imaginary, they have always this form, $x + \sqrt{-b^2}, x - \sqrt{-b^2}$, which quantities may also be expressed thus,

$$4L \qquad a+b$$

Equations in general. $a+b\sqrt{-1}$, $a-b\sqrt{-1}$, so that we have these two factors $x-a-b\sqrt{-1}$, $x-a+b\sqrt{-1}$, and taking their product, $x^2-2ax+a^2-b^2=0$.

Thus we see that two imaginary factors may be of such a form as to admit of their product being expressed by a real quantity; and hence the origin of imaginary roots in quadratic equations.

179. It appears by induction, that no real equation can be formed from imaginary factors, unless those factors be taken in pairs, and each pair have the form. $x\pm a-b\sqrt{-1}$, $x\pm a+b\sqrt{-1}$; for the product of three, or any odd number of imaginary factors, whatever be their form, is still an imaginary quantity. Thus, if we take the product of any three of these four imaginary expressions, $x+a+b\sqrt{-1}$, $x+a-b\sqrt{-1}$, $x+c+d\sqrt{-1}$, $x+c-d\sqrt{-1}$, we may form four different equations, each of which will involve imaginary quantities. If, however, each equation be multiplied by the remaining factor, which had not previously entered into its composition, the product will be found to be rational, and the same for all the four.

180. Hence we may deduce the three following inferences respecting the roots of equations:

1. If an equation have imaginary roots, it must have two, or four, or some even number of such roots.

2. If the degree of an equation be denoted by an odd number, that equation must have at least one real root.

3. If the degree of an equation be denoted by an even number, and that equation have one real root, it will also have another real root.

181. We shall now explain some transformations which are frequently necessary to prepare the higher orders of equations for a solution.

Any equation may have its positive roots changed into negative roots of the same value, and its negative roots into such as are positive, by changing the signs of the terms alternately, beginning with the second. The truth of this remark will be evident, if we take two equations,

$$\begin{aligned}(x-a)(x-b)(x+c) &= 0, \\ (x+a)(x+b)(x-c) &= 0,\end{aligned}$$

(which are such, that the positive roots of the one have the same values as the negative roots of the other), and multiply together their respective factors, for these equations will stand thus:

$$\begin{aligned}\left. \begin{array}{l} x^3 - a \\ -b \\ +c \end{array} \right\} x^2 - ac \Big\} x + abc = 0 \\ \left. \begin{array}{l} x^3 + a \\ +b \\ -c \end{array} \right\} x^2 - ac \Big\} x - abc = 0\end{aligned}$$

where it appears that the signs of the first and third terms are the same in each, but the signs of the second and fourth are just the opposite of each other. And this will be found to hold true, not only of cubic equations, but of all equations, to whatever order they belong.

182. It will sometimes be useful to transform an equation into another, that shall have each of its roots greater or less than the corresponding roots of the other equation, by some given quantity.

Let $(x-a)(x-b)(x+c)=0$ be any proposed equation which is to be transformed into another, having its roots greater or less than those of the proposed equation by the given quantity n ; then, because the roots of the transformed equation are to be $+a\pm n$, $+b\pm n$ and $-c\pm n$, the equation itself will be

$$(y\mp n-a)(y\mp n-b)(y\mp n+c)=0.$$

Hence the reason of the following rule is evident.

If the new equation is to have its roots greater than those of the proposed equation, instead of x and its powers, substitute $y-n$ and its powers; but if the roots are to be less, then instead of x substitute $y+n$; and in either case, a new equation will be produced, the roots of which shall have the property required.

183. By means of the preceding rule, an equation may be changed into another, which has its roots either all positive, or all negative; but it is chiefly used in preparing cubic and biquadratic equations for a solution, by transforming them into others of the same degrees, but which want their second term.

Let $x^3+px^2+qx+r=0$ be any cubic equation; if we substitute $y+n$ for x , the equation is changed into the following:

$$\left. \begin{array}{l} y^3 + 3n \\ + p \end{array} \right\} y^2 + \left. \begin{array}{l} 3n^2 \\ + 2pn \\ + q \end{array} \right\} y + \left. \begin{array}{l} n^3 \\ + pn^2 \\ + qn \\ + r \end{array} \right\} = 0.$$

Now, that this equation may want its second term, it is evident, that we have only to suppose $3n+p=0$, or

$n=-\frac{p}{3}$, for this assumption being made, and the value of n substituted in the remaining terms, the equation becomes

$$y^3 + \left(q - \frac{p^2}{3}\right)y + \frac{2p^3}{27} - \frac{pq}{3} + r = 0,$$

or putting $-\frac{p^2}{3} + q = q'$, and $+\frac{2p^3}{27} - \frac{pq}{3} + r = r'$, the same equation may also stand thus,

$$y^3 + q'y + r' = 0.$$

184. In general, any equation whatever may be transformed into another, which shall want its second term by the following rule.

Divide the coefficient of the second term of the proposed equation by the exponent of the first term, and add the quotient, with its sign changed, to a new unknown quantity; the sum being substituted for the unknown quantity in the proposed equation, a new equation will be produced, which will want the second term, as required.

185. By this rule, any affected quadratic equation may be readily resolved; for by transforming it into another equation, which wants the second term, we thus reduce its solution to that of a pure quadratic. Thus if the quadratic equation $x^2-5x+6=0$ be proposed; by substituting $y+\frac{5}{2}$ for x , we find

$$\left. \begin{array}{l} y^2 + 5y + \frac{25}{4} \\ - 5y + \frac{25}{2} \\ + 6 \end{array} \right\} = 0, \text{ or } y^2 - \frac{5}{4} = 0.$$

Hence $y = \pm\frac{5}{2}$, and since $x = y + \frac{5}{2}$, therefore $x = \pm\frac{5}{2} + \frac{5}{2} = +3$ or $+2$.

186. It has been shewn (§ 169.) that in any equation, the coefficient of the second term having its sign changed, is equal to the sum of all the roots, or abstracting

subtracting from their signs, it is equal to the difference between the sum of the positive, and the sum of the negative roots. Therefore, if the second term be wanting, the sum of the positive roots in the equation must necessarily be equal to that of the negative roots.

187. Instead of taking away the second term from an equation, any other term may be made to vanish, by an assumption similar to that which has been employed to take away the second term. Thus if in § 183. we assume $3n^2 + 2pn + q = 0$, by resolving this quadratic equation, a value of n will be found, which, when substituted in the equation, will cause the third term to vanish; and by the resolution of a cubic equation the third term might be taken away; and so on.

188. Another species of transformation, of use in the resolution of equations, is that by which an equation, having the coefficients of some of its terms expressed by fractional quantities, is changed into another, the coefficients of which are all integers.

Let $x^3 + \frac{p}{a}x^2 + \frac{q}{b}x + \frac{r}{c} = 0$ denote an equation to be so transformed; and let us assume $y = abcx$; and therefore $x = \frac{y}{abc}$, then, by substitution, our equation becomes

$$\frac{y^3}{a^3b^3c^3} + \frac{p}{a^3b^2c^2}y^2 + \frac{q}{ab^2c}y + \frac{r}{c} = 0,$$

and multiplying the whole equation by $a^3b^3c^3$, we have

$$y^3 + bcpy^2 + a^2bc^2qy + a^3b^3c^3r = 0.$$

Thus we have an equation free from fractions, while at the same time the coefficient of the highest power of the unknown quantity is unity, as before.

189. This transformation may always be performed by the following rule. Instead of the unknown quantity substitute a new unknown quantity divided by the product of all the denominators; then, by proper reduction, the equation will be found to have the form required.

190. If, however, the equation have this form,

$$x^3 + \frac{p}{a}x^2 + \frac{q}{a}x + \frac{r}{a} = 0,$$

it will be sufficient to assume $y = ax$, and therefore $x = \frac{y}{a}$; for then we have

$$\frac{y^3}{a^3} + \frac{p}{a^3}y^2 + \frac{q}{a^2}y + \frac{r}{a} = 0,$$

And $y^3 + py^2 + aqy + ar = 0$,

which last equation has the form required.

SECT. XI. Of Cubic Equations.

191. CUBIC equations, as well as equations of every higher degree, are, like quadratics, divided into two classes; they are said to be *pure*, when they contain only one power of the unknown quantity; and *affected*, when they contain two or more powers of that quantity.

192. Pure cubic equations are therefore of this form, $x^3 = 125$, or $x^3 = -27$, or, in general, $x^3 = r$; and hence it appears, that the value of the simple power of the unknown quantity may always be found, without difficulty, by extracting the cube root of each side of

the equation; thus from the first of the three preceding examples we find $x = +5$, from the second $x = -3$, and from the third $x = \sqrt[3]{r}$.

193. It would seem at first sight, that the only value which x can have in the cubic equation $x^3 = r$, or putting $r = c^3$, $x^3 - c^3 = 0$, is this one, $x = c$; but since $x^3 - c^3$ may be resolved into these two factors $x - c$ and $x^2 + cx + c^2$, it follows, that besides the value of r already found, which results from making the factor $x - c = 0$, it has yet other two values, which may be found by making the other factor $x^2 + cx + c^2 = 0$; and accordingly by resolving the quadratic equation

$$x^2 + cx = -c^2, \text{ we find these values to be } \frac{-c + \sqrt{-3c^2}}{2}$$

$$\text{and } \frac{-c - \sqrt{-3c^2}}{2}, \text{ or } \frac{-1 + \sqrt{-3}}{2}c \text{ and } \frac{-1 - \sqrt{-3}}{2}c.$$

Thus it appears, that any cubic equation of this form, $x^3 = c^3$, or $x^3 - c^3 = 0$, has these three roots,

$$x = c, x = \frac{-1 + \sqrt{-3}}{2}c, x = \frac{-1 - \sqrt{-3}}{2}c,$$

the first of which is real, but the two last are imaginary. If, however, each of the imaginary values of x be raised to the third power, the same results will be obtained as from the real value of x ; the original equation $x^3 - c^3 = 0$ may also be reproduced, by multiplying together the three factors $x - c, x - \frac{-1 + \sqrt{-3}}{2}c,$

$$\text{and } x - \frac{-1 - \sqrt{-3}}{2}c.$$

194. Let us now consider such cubic equations as have all their terms, and which are therefore of this form,

$$x^3 + Ax^2 + Bx + C = 0,$$

where A, B, and C denote known quantities, either positive or negative.

It has been shewn (§ 184.) how an equation having all its terms may be transformed into another, which wants the second term; let us therefore assume $x = y - \frac{A}{3}$, as directed in that article; then, by proper substitution, the above equation will be changed into another of this form,

$$y^3 + qy + r = 0,$$

where q and r denote known quantities, whether positive or negative; now the roots of this equation being once found, it is evident that those of the former may also be readily obtained by means of the assumed equation $x = y - \frac{A}{3}$.

195. Resuming, therefore, the equation $y^3 + qy + r = 0$, let us suppose $y = v + z$, and it becomes

$$\left. \begin{aligned} v^3 + 3v^2z + 3vz^2 + z^3 \\ + qv + qz \end{aligned} \right\} = 0.$$

Thus we have got a new equation, which, as it involves two unknown quantities, v and z , may be resolved into any two other equations, which will simplify the determination of those quantities.

Now it appears, that the only way in which we can

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divide that equation into two others, so as to simplify the question, is the following

$$3v^2z + 3vz^2 + qv + qz = 0$$

$$v^3 + z^3 + r = 0.$$

The first of these equations may also be expressed thus,

$$(3vz + q)(v + z) = 0.$$

Hence we must either suppose that $v + z = 0$, or that $3vz + q = 0$; but the former supposition cannot be admitted, without supposing also that $y = 0$, which does not agree with the hypothesis of the equation $y^3 + qy + r = 0$; therefore we must adopt the latter. So that to determine v and z we have these two equations,

$$3vz + q = 0, \quad v^3 + z^3 + r = 0.$$

From the first, we find $vz = -\frac{q}{3}$, and $v^3z^3 = -\frac{q^3}{27}$; and from the second $v^3 + z^3 = -r$, so that to determine the quantities v^3 and z^3 , we have given their sum, and product: now this is a problem which we have already resolved when treating of quadratic equations, § 155; and by proceeding in the same manner, in the present case we shall find

$$v^3 = -\frac{1}{2}r + \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}, \quad z^3 = -\frac{1}{2}r - \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}$$

$$v = \sqrt[3]{-\frac{1}{2}r + \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}}, \quad z = \sqrt[3]{-\frac{1}{2}r - \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}}$$

and $y = v + z = \sqrt[3]{-\frac{1}{2}r + \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}} + \sqrt[3]{-\frac{1}{2}r - \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}}$

Thus we have at last obtained a value of the unknown quantity y , in terms of the known quantities q and r ; therefore the equation is resolved.

196. But this is only one of three values which y may have; let us, for the sake of brevity, put

$$A = -\frac{1}{2}r + \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}, \quad B = -\frac{1}{2}r - \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2},$$

and denote the imaginary expressions

$$\frac{-1 + \sqrt{-3}}{2}, \quad \frac{-1 - \sqrt{-3}}{2}$$

by α and β . Then, from what has been shewn (§ 193), it is evident that v and z have each these three values,

$$v = \sqrt[3]{A}, \quad v = \alpha \sqrt[3]{A}, \quad v = \beta \sqrt[3]{A},$$

$$z = \sqrt[3]{B}, \quad z = \alpha \sqrt[3]{B}, \quad z = \beta \sqrt[3]{B}.$$

To determine the corresponding values of v and z , we must consider that $vz = -\frac{q}{3} = \sqrt[3]{AB}$; now if we observe that $\alpha\beta = 1$, it will immediately appear that $v + z$ has these three values,

$$v + z = \sqrt[3]{A} + \sqrt[3]{B}$$

$$v + z = \alpha \sqrt[3]{A} + \beta \sqrt[3]{B}$$

$$v + z = \beta \sqrt[3]{A} + \alpha \sqrt[3]{B}$$

Hence the three values of y are also these,

$$y = \sqrt[3]{A} + \sqrt[3]{B}$$

$$y = \alpha \sqrt[3]{A} + \beta \sqrt[3]{B}$$

$$y = \beta \sqrt[3]{A} + \alpha \sqrt[3]{B}.$$

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The first of these formulæ is commonly known by the name of Cardan's rule; but it is well known that Cardan was not the inventor, and that it ought to be attributed to Nicholas Tartalea, and Scipio Ferreus, who discovered it much about the same time, and independently of each other (see the *Introduction*.)

197. The formulæ given in last article for the roots of a cubic equation may be put under a different form, and perhaps better adapted to the purposes of arithmetical calculation as follows. Because $vz = -\frac{q}{3}$,

therefore $z = -\frac{q}{3} \times \frac{1}{v} = -\frac{q}{3} \times \frac{1}{\sqrt[3]{A}}$, hence $v + z = \sqrt[3]{A} - \frac{\frac{1}{3}q}{\sqrt[3]{A}}$; thus it appears that the three values of y

may also be expressed thus,

$$y = \sqrt[3]{A} - \frac{\frac{1}{3}q}{\sqrt[3]{A}}$$

$$y = \alpha \sqrt[3]{A} - \frac{\frac{1}{3}q\beta}{\sqrt[3]{A}}$$

$$y = \beta \sqrt[3]{A} - \frac{\frac{1}{3}q\alpha}{\sqrt[3]{A}}$$

198. To show the manner of applying these formulæ, let it be required to determine x from the cubic equation

$$x^3 + 3x^2 + 9x - 13 = 0.$$

And as this equation has all its terms, the first step towards its resolution is to transform it into another which shall want the second term, by substituting $y - 1$ for x as directed (§ 184). The operation will stand thus,

$$\begin{array}{r} x^3 = y^3 - 3y^2 + 3y - 1 \\ + 3x^2 = + 3y^2 - 6y + 3 \\ + 9x = + 9y - 9 \\ - 13 = - 13 \end{array}$$

The transformed equation is $y^3 + 6y - 20 = 0$ which being compared with the general equation

$$y^3 + qy + r = 0$$

gives $q = 6$, $r = -20$; hence

$$A = \sqrt[3]{-\frac{1}{2}r + \sqrt{\frac{1}{27}q^3 + \frac{1}{4}r^2}} = \sqrt[3]{10 + \sqrt{108}}$$

Therefore, the first formula of last article gives $y = \sqrt[3]{10 + \sqrt{108}} - \frac{2}{\sqrt[3]{10 + \sqrt{108}}}$; but as this expression

involves a radical quantity, let the square root of 108 be taken and added to 10, and the cube root of the sum found; thus we have $\sqrt[3]{10 + \sqrt{108}} = 2.732$, nearly, and

able Equations. and therefore $\sqrt[3]{10+\sqrt{108}} = \frac{2}{2.732} = .732$; hence we at last find one of the values of y to be $2.732 - .732 = 2$.

In finding the cube root of the radical quantity $\sqrt[3]{10+\sqrt{108}}$ we have taken only its approximate value, so as to have the expression for the root under a rational form, and in this way we can always find, as near as we please, the cube root of any surd of the form $a + \sqrt{b}$ where b is a positive number. But it will sometimes happen that the cube root of such a surd can be expressed exactly by another surd of the same form; and accordingly, in the present case, it appears that the cube root of $10 + \sqrt{108}$ is $1 + \sqrt{3}$, as may be proved by actually raising $1 + \sqrt{3}$ to the third power. Hence

$$\text{we find } \sqrt[3]{10+\sqrt{108}} = \frac{2}{1+\sqrt{3}} = \frac{2(1-\sqrt{3})}{(1-\sqrt{3})(1+\sqrt{3})} = -(1-\sqrt{3}); \text{ so that we have } y = 1 + \sqrt{3} + 1 - \sqrt{3} = 2, \text{ as before.}$$

The other two values of y will be had by substituting $1 + \sqrt{3}$ and $1 - \sqrt{3}$ for \sqrt{A} and $\frac{\sqrt[3]{q}}{\sqrt[3]{A}}$ in the second and third formulæ of last article, also restoring the values of α and β . We thus have

$$y = \frac{-1 + \sqrt{-3}}{2} \times (1 + \sqrt{3}) + \frac{-1 - \sqrt{-3}}{2} \times (1 - \sqrt{3}) = 1 + \sqrt{-9}$$

$$y = \frac{-1 - \sqrt{-3}}{2} \times (1 + \sqrt{3}) + \frac{-1 + \sqrt{-3}}{2} \times (1 - \sqrt{3}) = -1 - \sqrt{-9}.$$

So that the three values of y are

$$+2, -1 + \sqrt{-9}, -1 - \sqrt{9},$$

and since $x = y + 1$, the corresponding values of x are $+1, -2 + \sqrt{-9}, -2 - \sqrt{-9}$.

Thus it appears that one of the roots of the proposed equation is real and the other two imaginary.

The two imaginary roots might have been found otherwise, by considering that since one root of the equation is 1, the equation must be divisible by $x - 1$ (§ 163.). Accordingly the division being actually performed, and the quotient put $= 0$, we have this quadratic equation,

$$x^2 + 4x + 13 = 0;$$

which, when resolved by the rule for quadratics, gives $x = -2 \pm \sqrt{9}$, the same imaginary value as before.

199. In the application of the preceding formulæ (§ 196 and 197) to the resolution of the equation $y^3 + qy + r = 0$, it is necessary to find the square root of $\frac{r}{q} + \frac{4}{27}r^3$, now when that quantity is positive, as in the equation $y^3 + 6y - 20 = 0$, which was resolved in last article, no difficulty occurs, for its root may be found, either exactly, or to as great a degree of accuracy as we please.

As, however, the coefficients q and r are independent of each other, it is evident that q may be nega-

tive, and such that $\frac{r}{q} + \frac{4}{27}r^3$ is greater than $\frac{4}{27}r^3$, in this case the expression $\frac{r}{q} + \frac{4}{27}r^3 + \frac{4}{27}r^3$ will be negative, and therefore its square root an imaginary quantity. Let us take as an example this equation $y^3 - 6y + 4 = 0$; here $q = -6$, $r = +4$, $\frac{r}{q} = -\frac{2}{3}$, $\frac{r}{q} + \frac{4}{27}r^3 = -\frac{2}{3} + \frac{4}{27} = -\frac{10}{27}$, $\sqrt{-\frac{10}{27}} = \sqrt{-\frac{10}{27}}$, hence by recurring to the formulæ (§ 196.), we have $A = 2 + 2\sqrt{-1}$, $B = 2 - \sqrt{-1}$, and therefore the three roots of the equation expressed thus,

$$y = \sqrt[3]{2+2\sqrt{-1}} + \sqrt[3]{2-2\sqrt{-1}}$$

$$y = \alpha \sqrt[3]{2+2\sqrt{-1}} + \beta \sqrt[3]{2-2\sqrt{-1}}$$

$$y = \beta \sqrt[3]{2+2\sqrt{-1}} + \alpha \sqrt[3]{2-2\sqrt{-1}}.$$

Here all the roots appear under an imaginary form; but we are certain from the theory of equations, as explained in Sect. X. that every cubic equation must have at least one real root. The truth is, as we shall shew immediately, that in this case, so far from any of the roots being imaginary (as in the former example), they are all real; for it appears by actual involution that the imaginary expression $2 + 2\sqrt{-1}$ is the cube of this other imaginary expression $-1 + \sqrt{-1}$, and in like manner, that $2 - 2\sqrt{-1}$ is the cube of $-1 - \sqrt{-1}$, so that we have

$$y = \sqrt[3]{2+2\sqrt{-1}} + \sqrt[3]{2-2\sqrt{-1}} = -1 + \sqrt{-1} - 1 - \sqrt{-1} = -2$$

$$y = \frac{-1 + \sqrt{-3}}{2} \times (-1 + \sqrt{-1}) + \frac{-1 - \sqrt{-3}}{2} \times (-1 - \sqrt{-1} = 1) + \sqrt{3}$$

$$y = \frac{-1 - \sqrt{-3}}{2} \times (-1 + \sqrt{-1}) + \frac{-1 + \sqrt{-3}}{2} \times (-1 - \sqrt{-1}) = 1 - \sqrt{3}.$$

200. We now proceed to prove in general, that as often as the roots of the equation $x^3 + qx + r = 0$ are real, q is negative, and $\frac{r}{q} + \frac{4}{27}r^3$ greater than $\frac{4}{27}r^3$; and, on the contrary, that if $\frac{r}{q} + \frac{4}{27}r^3$ be greater than $\frac{4}{27}r^3$ the roots are all real.

Let us suppose a to be a real root of the proposed equation,

$$\text{Then } x^3 + qx + r = 0$$

$$\text{And } a^3 + qa + r = 0.$$

And therefore by subtraction $x^3 - a^3 + q(x - a) = 0$; hence, dividing $x^3 - a^3$, also $q(x - a)$ by $x - a$, we have

$$x^2 + ax + a^2 + q = 0.$$

This quadratic equation is formed from the two remaining roots of the proposed equation, and by resolving it we find

$$x = -\frac{1}{2}a \pm \sqrt{-\frac{3}{4}a^2 - q}.$$

And as, by hypothesis, all the roots are real, it is evident that q must necessarily be negative, and greater than $\frac{4}{27}a^3$; for otherwise the expression $\sqrt{-\frac{3}{4}a^2 - q}$ would be imaginary. Let us change the sign of q , and put

Cubic Equations. put $q = \frac{3}{4}a^2 + d$; thus the roots of the equation $x^3 + qx + r = 0$ will be

$$a, -\frac{1}{2}a + \sqrt[3]{d}, -\frac{1}{2}a - \sqrt[3]{d},$$

and here d is a positive quantity.

To find an expression for r in terms of a and d , let $\frac{3}{4}a^2 + d$ be substituted for q in the equation $x^3 - qa + r = 0$; we thence find $r = -\frac{3}{4}a^3 + ad$; so that to compare together the quantities q and r we have these equations,

$$q = \frac{3}{4}a^2 + d \\ r = -\frac{3}{4}a^3 + ad.$$

In order to make this comparison, let the cube of $\frac{1}{2}q$ be taken, also the square of $\frac{1}{2}r$, the results are

$$\frac{1}{8}q^3 = \frac{1}{64}a^6 + \frac{1}{16}a^4d + \frac{1}{8}a^2d^2 + \frac{1}{8}q^3d^3 \\ \frac{1}{4}r^2 = \frac{1}{64}a^6 - \frac{1}{8}a^4d + \frac{1}{4}a^2d^2;$$

and therefore by subtraction,

$$\frac{1}{8}q^3 - \frac{1}{4}r^2 = \frac{1}{16}a^4d - \frac{1}{6}a^2d^2 + \frac{1}{8}q^3d^3 \\ = 3d(\frac{1}{16}a^4 - \frac{1}{8}a^2d + \frac{1}{8}q^3d^2) \\ = 3d(\frac{1}{4}a^2 - \frac{1}{2}d)^2.$$

Now the square of any real quantity being always positive, it follows, that $3d(\frac{1}{4}a^2 - \frac{1}{2}d)^2$ will be positive when d is positive; hence it is evident that in this case $\frac{1}{8}q^3$ must be greater than $\frac{1}{4}r^2$; and that the contrary cannot be true unless d be negative, that is, unless that $-\frac{1}{2}a + \sqrt[3]{d}, -\frac{1}{2}a - \sqrt[3]{d}$, the two other roots of the equation, are imaginary. If we suppose $d = 0$, then $\frac{1}{8}q^3 = \frac{1}{4}r^2$; and the roots of the equations, which in this case are also real, are $a, -\frac{1}{2}a, -\frac{1}{2}a$.

Upon the whole, therefore, we infer, that since a cubic equation has always one real root, its roots will be all real as often as q is negative, and $\frac{1}{8}q^3$ greater than $\frac{1}{4}r^2$; and consequently, that in this case the formulæ for the roots must express real quantities notwithstanding their imaginary form.

201. Let $y^3 - qy + r = 0$ denote any equation of the form which has been considered in last article, namely, that which has its roots all real; then, if we put $a = -\frac{1}{2}r$, $b^3 = \frac{1}{2}q^3 - \frac{1}{4}r^2$, one of the roots, as expressed by the first formula, § 196. will be,

$$y = \sqrt[3]{a + b\sqrt{-1}} + \sqrt[3]{a - b\sqrt{-1}}.$$

This expression, although under an imaginary form, must (as we have shewn in last article) represent a real quantity. It will sometimes happen, as in last example, § 199. that the two surds which compose the root are perfect cubes of the form $(A + B\sqrt{-1})^3$ and $(A - B\sqrt{-1})^3$, and then the value of y becomes

$$A + B\sqrt{-1} + A - B\sqrt{-1} = 2A.$$

But the rules for determining when this is the case depend upon trials, and are, besides, troublesome in the application; and if we attempt by a direct process to investigate the numerical values of A and B , we are brought to a cubic equation of the very same form as that whose root is required.

202. This imaginary expression for a real quantity has greatly perplexed mathematicians; and much pains has been taken to obtain the root under another form, but without success. Accordingly, the case of cubic equations, in which the roots are all real, is now called the *irreducible case*.

203. It is remarkable that the expression

$$\sqrt[n]{a + b\sqrt{-1}} + \sqrt[n]{a - b\sqrt{-1}},$$

and in general,

$$\sqrt[n]{a + b\sqrt{-1}} + \sqrt[n]{a - b\sqrt{-1}},$$

where n is any power of 2, admits of being reduced to another form in which no impossible quantity is found.

$$\text{Thus } \sqrt[n]{a + b\sqrt{-1}} + \sqrt[n]{a - b\sqrt{-1}} = \sqrt[n]{2a + 2\sqrt[n]{a^2 + b^2}} \\ \sqrt[n]{a + b\sqrt{-1}} + \sqrt[n]{a - b\sqrt{-1}} = \sqrt{\left(\sqrt[n]{2a + 2\sqrt[n]{a^2 + b^2}} + 2\sqrt[n]{a^2 + b^2}\right)},$$

as is easily proved by first squaring the imaginary formulæ, and then taking the square root of each. But when n is 3, it does not seem that such reduction can possibly take place.

204. If each of the surds be expanded into an infinite series and their sum be taken, the imaginary quantity $\sqrt{-1}$ will vanish; and thus the root may be found by a direct process. There are, however, other methods which seem preferable; and the following, which is derived from the application of algebra to geometry, seems to be the best.

205. It will be demonstrated in Sect. XXV. that if a denote an arch of a circle, the relation between the cosine of the arch and the cosine of $\frac{a}{3}$, one third of that arch, is expressed by the following cubic equation.

$$\cos.^3 \frac{a}{3} - \frac{1}{4} \cos. \frac{a}{3} = \frac{1}{4} \cos. a.$$

Let us assume $\cos. \frac{a}{3} = \frac{y}{n}$, then, by substitution, the equation is transformed into the following:

$$\frac{y^3}{n^3} - \frac{3y}{4n} = \frac{1}{4} \cos. a.$$

$$\text{Or } y^3 - \frac{3n^2}{4}y = n^3 \times \frac{1}{4} \cos. a,$$

and in this cubic equation one of the roots is evidently $y = n \times \cos. \frac{a}{3}$. Now from the arithmetic of sines it appears that $\cos. a, \cos. (360^\circ - a)$, and $\cos. (360^\circ + a)$, are all expressed by the same quantity; therefore the equation must have for a root not only $n \times \cos. \frac{a}{3}$, but

also $n \times \cos. \frac{360^\circ - a}{3}$ and $n \times \cos. \frac{360^\circ + a}{3}$. But from the arithmetic of sines, $\cos. \frac{360^\circ - a}{3} = -\sin. \frac{90^\circ - a}{3}$ and $\cos. \frac{360^\circ + a}{3} = -\sin. \frac{90^\circ + a}{3}$. Therefore the roots of the equation are

$$n \times \cos. \frac{a}{3}, -n \times \sin. \frac{90^\circ - a}{3}, -n \times \sin. \frac{90^\circ + a}{3}.$$

Let us next suppose that $y^3 - qy = r$ is a cubic equation

tion whose roots are required, and let us compare it with the former equation $y^3 - \frac{3n^2}{4}y = n^3 \times \cos. \frac{r}{4}a$; then it is evident that if we assume the quantities n and $\cos. a$, such, that

$$\frac{3n^2}{4} = q, \quad n^3 \times \cos. \frac{r}{4}a = r,$$

the two equations will become identical, and thus their roots will be expressed by the very same quantities. But from these two assumed equations we find

$$n = \sqrt{\frac{4q}{3}} = \frac{2\sqrt{q}}{\sqrt{3}}, \quad \cos. a = \frac{4r}{n^3} = \sqrt{\frac{27r^2}{4q^3}} = \frac{3r\sqrt{3}}{2q\sqrt{q}},$$

and since the cosine of an arch cannot exceed unity,

therefore, $\frac{27r^2}{4q^3}$ must be a proper fraction, that is, $4q^3$

must exceed $27r^2$, or $\frac{r}{4}q^3$ must exceed $\frac{r}{4}r^2$; if we now recollect that q is a negative quantity, it will immediately appear that the proposed equation must necessarily belong to the irreducible case.

206. The rule, therefore, which we derive from the preceding analysis for resolving that case is as follows.

Let $y^3 - qy = r$ be the proposed equation.

Find in the trigonometrical tables an arch a , whose natural cosine

$$= \frac{3r\sqrt{3}}{2q\sqrt{q}}.$$

The roots of the equation are

$$y = 2\sqrt{\frac{q}{3}} \times \cos. \frac{a}{3}$$

$$y = -2\sqrt{\frac{q}{3}} \times \sin. \frac{90^\circ - a}{3}$$

$$y = -2\sqrt{\frac{q}{3}} \times \sin. \frac{90^\circ + a}{3}.$$

These formulæ will apply, whether r be positive or negative, by proper attention to the signs: If, however, r be negative, or the equation have this form, $y^3 - qy = -r$, the following will be more convenient:

Find in the tables an arch a , whose sine $= \frac{3r\sqrt{3}}{2q\sqrt{q}}$

Then the roots of the equation are

$$y = 2\sqrt{\frac{q}{3}} \times \sin. \frac{a}{3}$$

$$y = 2\sqrt{\frac{q}{3}} \times \cos. \frac{90^\circ + a}{3}$$

$$y = -2\sqrt{\frac{q}{3}} \times \cos. \frac{90^\circ - a}{3}.$$

The last formulæ are derived from the equation

$$\sin. \frac{3a}{3} - \frac{3}{4} \sin. \frac{a}{3} = -\sin. a$$

in the same manner as the former were found from the first equation of last article.

Ex. 1. It is required to find the roots of the equation $x^3 - 3x = 1$.

Here $\frac{3r\sqrt{3}}{2q\sqrt{q}} = \frac{3 \times \sqrt{3}}{6 \times \sqrt{3}} = \frac{1}{2} = \cos. 60^\circ = \cos. a.$

Hence
$$\begin{cases} x = 2 \cos. \frac{60^\circ}{3} = 2 \cos. 20^\circ = 1.8793852 \\ x = -2 \sin. \frac{150^\circ}{3} = -2 \sin. 50^\circ = -1.5320888 \\ x = -2 \sin. \frac{30^\circ}{3} = -2 \sin. 10^\circ = .3472964. \end{cases}$$

Biquadratic Equations.

Ex. 2. It is required to find the roots of the equation $x^3 - 3x = 1$.

Here $\frac{3r\sqrt{3}}{2q\sqrt{q}} = \frac{3\sqrt{3}}{6\sqrt{3}} = \frac{1}{2} = \sin. 30^\circ = \sin. a.$

$$x = 2 \sin. \frac{30^\circ}{3} = 2 \sin. 10^\circ = .3472964$$

$$x = 2 \cos. \frac{120^\circ}{3} = 2 \cos. 40^\circ = 1.5320888$$

$$x = -2 \cos. \frac{60^\circ}{3} = -2 \cos. 20^\circ = -1.8793852$$

SECT. XII. Of Biquadratic Equations.

207. WHEN a biquadratic equation contains all its terms, it has this form,

$$x^4 + Ax^3 + Bx^2 + Cx + D = 0,$$

where A, B, C, D, denote any known quantities whatever.

208. We shall first consider pure biquadratics, or such as contain only the first and last terms, and therefore are of this form, $x^4 = b^4$. In this case it is evident that x may be readily had by two extractions of the square root; by the first we find $x^2 = b^2$, and by the second $x = b$. This, however, is only one of the values which x may have; for since $x^2 = b^2$, therefore $x^2 - b^2 = 0$; but $x^2 - b^2$ may be resolved into two factors $x^2 - b^2$ and $x^2 + b^2$, each of which admit of a similar resolution; for $x^2 - b^2 = (x - b)(x + b)$ and $x^2 + b^2 = (x - b\sqrt{-1})(x + b\sqrt{-1})$. Hence it appears that the equation $x^4 - b^4 = 0$ may also be expressed thus:

$$(x - b)(x + b)(x - b\sqrt{-1})(x + b\sqrt{-1}) = 0,$$

so that x may have these four values,

$$+b, -b, +b\sqrt{-1}, -b\sqrt{-1},$$

two of which are real and the others imaginary.

209. Next to pure biquadratic equations, in respect of easiness of resolution, are such as want the second and fourth terms, and therefore have this form,

$$x^4 + qx^2 + s = 0.$$

These may be resolved in the manner of quadratic equations; for if we put $y^2 = x^2$ we have

$$y^2 + qy + s = 0.$$

from which we find $y = \frac{-b \pm \sqrt{q^2 - 4s}}{2}$, and therefore

$$x = \pm \sqrt{\frac{-q \pm \sqrt{q^2 - 4s}}{2}}.$$

210. When a biquadratic equation has all its terms, the manner of resolving it is not so obvious as in the two former cases, but its resolution may be always reduced to that of a cubic equation. There are various methods by which such a reduction may be effected; the following, which we select as one of the most ingenious, was first given by Euler in the Petersburg Commentaries, and

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and afterwards explained more fully in his Elements of Algebra.

We have already explained, § 184, in what manner an equation which is complete in its terms may be transformed into another equation of the same degree, but which wants the second term; therefore, any proposed biquadratic equation may be reduced to this form,

$$y^4 + py^2 + qy + r = 0,$$

where the second term is wanting, and where p, q, r , denote any known quantities whatever.

211. That we may form any equation similar to the above, let us assume $y = \sqrt{a} + \sqrt{b} + \sqrt{c}$, and let us also suppose that the letters a, b, c , denote the roots of the cubic equation

$$x^3 + Px^2 + Qx - R = 0;$$

then from the theory of equations we have

$$a + b + c = -P, \quad ab + ac + bc = Q, \quad abc = R.$$

Let us now square the assumed formula

$$y = \sqrt{a} + \sqrt{b} + \sqrt{c}, \text{ and we obtain}$$

$$y^2 = a + b + c + 2(\sqrt{ab} + \sqrt{ac} + \sqrt{bc})$$

or substituting $-P$ for $a + b + c$, and transposing

$$y^2 + P = 2(\sqrt{ab} + \sqrt{ac} + \sqrt{bc}).$$

Let this equation be also squared, and we have

$$y^4 + 2Py^2 + P^2 = 4(ab + ac + bc) + 8(\sqrt{a^2bc} + \sqrt{ab^2c} + \sqrt{abc^2}),$$

and since $ab + ac + bc = Q$ and $\sqrt{a^2bc} + \sqrt{ab^2c} + \sqrt{abc^2} = \sqrt{abc}(\sqrt{a} + \sqrt{b} + \sqrt{c}) = \sqrt{R}y$; the same equation may be expressed thus:

$$y^4 + 2Py^2 + P^2 = 4Q + 8\sqrt{R}y.$$

Thus we have obtained the biquadratic equation

$$y^4 + 2Py^2 - 8\sqrt{R}y + P^2 - 4Q = 0,$$

one of the roots of which $y = \sqrt{a} + \sqrt{b} + \sqrt{c}$, and in which a, b, c , are the roots of the cubic equation $x^3 + Px^2 + Qx - R = 0$.

212. That we may apply this resolution to the proposed equation $y^4 + py^2 + qy + r = 0$, we must express the assumed coefficients P, Q, R by means of p, q, r the coefficients of that equation. For this purpose let us compare together the equations

$$y^4 + py^2 + qy + r = 0$$

$$y^4 + 2Py^2 - 8\sqrt{R}y + P^2 - 4Q = 0,$$

and it immediately appears that $2P = p$, $-8\sqrt{R} = q$, $P^2 - 4Q = r$; and from these three equations we find

$$P = \frac{p}{2}, \quad Q = \frac{p^2 - 4r}{16}, \quad R = \frac{q^2}{64}.$$

Hence it follows, that the roots of the proposed equation are generally expressed by the formula $y = \sqrt{a} + \sqrt{b} + \sqrt{c}$; where a, b, c , denote the roots of this cubic equation

$$x^3 + \frac{p}{2}x^2 + \frac{p^2 - 4r}{16}x - \frac{q^2}{64} = 0.$$

213. But to find each particular root, we must consider, that as the square root of a number may be either positive or negative, so each of the quantities, $\sqrt{a}, \sqrt{b}, \sqrt{c}$, may have either the sign + or - prefixed to it; and hence our formula will give eight different expressions for the root. It is, however, to be observed, that as the product of the three quantities

$\sqrt{a}, \sqrt{b}, \sqrt{c}$, must be equal to \sqrt{R} or to $-\frac{q}{8}$, Biquad-
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tions.

therefore when q is positive, their product must be a negative quantity; and this can only be effected by making either one or three of them negative; again, when q is negative, their product must be a positive quantity; so that in this case they must either be all positive, or two of them must be negative. These considerations enable us to determine, that four of the eight expressions for the root belong to the case in which q is positive, and the other four to that in which it is negative.

214. We shall now give the result of the preceding investigation, in the form of a practical rule for resolving biquadratic equations; and as the coefficients of the cubic equation which has been found, § 212, involve fractions, we shall transform it into another, in which the coefficients are integers, by supposing $x = \frac{v}{4}$. Thus the equation $x^3 + \frac{p}{2}x^2 + \frac{p^2 - 4r}{16}x - \frac{q^2}{64} = 0$ becomes, after reduction, $v^3 + 2pv^2 + (p^2 - 4r)v - q^2 = 0$; it also follows, that since the roots of the former equation are a, b, c , the roots of the latter are $\frac{a}{4}, \frac{b}{4}, \frac{c}{4}$, so that our rule may now be expressed thus:

Let $y^4 + py^2 + qy + r = 0$ be any biquadratic equation wanting its second term. Form this cubic equation

$$v^3 + 2pv^2 + (p^2 - 4r)v - q^2 = 0,$$

and find its roots, which let us denote by a, b, c .

Then the roots of the proposed biquadratic equation are,

when q is negative,

$$y = \frac{1}{2}(\sqrt{a} + \sqrt{b} + \sqrt{c})$$

$$y = \frac{1}{2}(\sqrt{a} - \sqrt{b} - \sqrt{c})$$

$$y = \frac{1}{2}(-\sqrt{a} + \sqrt{b} - \sqrt{c})$$

$$y = \frac{1}{2}(-\sqrt{a} - \sqrt{b} + \sqrt{c})$$

when q is positive,

$$y = \frac{1}{2}(-\sqrt{a} - \sqrt{b} - \sqrt{c})$$

$$y = \frac{1}{2}(-\sqrt{a} + \sqrt{b} + \sqrt{c})$$

$$y = \frac{1}{2}(\sqrt{a} - \sqrt{b} + \sqrt{c})$$

$$y = \frac{1}{2}(\sqrt{a} + \sqrt{b} - \sqrt{c}).$$

215. This resolution of biquadratic equations suggests the following general remarks upon the nature of their roots.

1. It is evident from the form of the roots, that if the cubic equation

$$v^3 + 2pv^2 + (p^2 - 4r)v - q^2 = 0$$

have all its roots real, and positive, those of the biquadratic equation shall be all real.

2. Since the last term of the cubic equation is negative, when its three roots are real, they must either be all positive, or two of them must be negative and one positive; for the last term is equal to the product of all the roots taken with contrary signs, § 169; so that in this last case two of the three quantities a, b, c , must be negative, and therefore all the four roots of the biquadratic equation imaginary. If, however, the two negative roots be equal, they will destroy each other in two of the roots of the biquadratic equation, which will then become real and equal. Let us suppose for example that b and c are negative and equal; the two first values of y in each column become then imaginary,

Biquadratic, and the remaining values of y are in the first set of roots $y = -\frac{1}{2}\sqrt{a}$, $y = -\frac{1}{2}\sqrt{a}$, and in the second set $y = +\frac{1}{2}\sqrt{a}$, $y = +\frac{1}{2}\sqrt{a}$.

3. When the cubic equation has only one real and two imaginary roots, its real roots must necessarily be positive. For the imaginary roots can only come from a quadratic equation, having its last term positive, Sect. IX. and therefore of this form, $v^2 + Av + B = 0$, hence, the simple factor which contains the remaining root must have this form $v - \gamma$, otherwise the last term of the cubic equation could not be negative.

By resolving the equation $v^3 + Av + B = 0$, we find

$$v = -\frac{A}{2} \pm \sqrt{\frac{A^2}{4} - B};$$

here, the roots being supposed imaginary, $\frac{A^2}{4} - B$ must be a negative quantity. That we may simplify the form of the roots, let us put $-\frac{A}{2} = \alpha$, and $\frac{A^2}{4} - B = -\beta^2$, then

$$v = -\alpha \pm \sqrt{-\beta^2} = -\alpha \pm \beta\sqrt{-1}$$

$$\text{and } v = -\alpha + \beta\sqrt{-1}, v = -\alpha - \beta\sqrt{-1}.$$

Hence we have

$$a = \alpha + \beta\sqrt{-1}, b = \alpha - \beta\sqrt{-1}, c = \gamma;$$

so that in two of the four values of y , we have a quantity of this form,

$$\sqrt{\alpha + \beta\sqrt{-1}} + \sqrt{\alpha - \beta\sqrt{-1}};$$

but this quantity, although it appears to be imaginary, is indeed real; for if we first square it, and then take its square root, it becomes

$$\sqrt{2\alpha + 2\sqrt{\alpha^2 + \beta^2}},$$

which is a real quantity. The two other roots involve this other expression,

$$\sqrt{\alpha + \beta\sqrt{-1}} - \sqrt{\alpha - \beta\sqrt{-1}};$$

which being treated in the same manner as the former, becomes

$$\sqrt{2\alpha - 2\sqrt{\alpha^2 + \beta^2}},$$

an imaginary quantity, and therefore the roots into which it enters are imaginary.

4. We may discover from the coefficients of the proposed biquadratic equation in what case the roots of the cubic equation are all real; for this purpose, the latter is to be transformed into another which shall want the second term, by assuming $v = u - \frac{2p}{3}$; thus it becomes

$$u^3 - \left(\frac{p^3}{3} + 4r\right)u - \frac{2p^3}{27} + \frac{8rp}{3} - q^2 = 0;$$

and in this equation the three roots will be real when

$$\frac{1}{27} \left(\frac{p^3}{3} + 4r\right)^3 \text{ is greater than } \frac{1}{4} \left(\frac{2p^3}{27} - \frac{8rp}{3} + q^2\right)^2.$$

216. As an example of the method of resolving a biquadratic equation, let it be required to determine the roots of the following,

$$x^4 - 25x^2 + 60x - 36 = 0.$$

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By comparing this equation with the general formula, we have $p = -25$, $q = +60$, $r = -36$; hence

$$2p = -50, p^2 - 4r = 769, q^2 = 3600,$$

and the cubic equation to be resolved is

$$v^3 - 50v^2 + 769v - 3600 = 0;$$

the roots of which are found, by the rules for cubics, to be 9, 16, and 25, so that we have $\sqrt{a} = 3$, $\sqrt{b} = 4$, $\sqrt{c} = 5$. Now in this case q is positive, therefore

$$x = \frac{1}{2}(-3 - 4 - 5) = -6$$

$$x = \frac{1}{2}(-3 + 4 + 5) = +3$$

$$x = \frac{1}{2}(+3 - 4 + 5) = +2$$

$$x = \frac{1}{2}(+3 + 4 - 5) = +1.$$

217. We have now explained the particular rules by which the roots of equations belonging to each of the first four orders may be determined; and this is the greatest length mathematicians have been able to go in the direct resolution of equations; for as to those of the fifth, and all higher degrees, no general method has hitherto been found, either for resolving them directly, or for reducing them to others of an inferior degree.

It even appears that the formulæ which express the roots of cubic equations are by no means of universal application; for in one case, that is, when the roots are all real, they become illusory, so that no conclusion can be drawn from them. The same observation will also apply to the formulæ for the roots of biquadratic equations, because, before they can be applied, it is always necessary to find the roots of a cubic equation. But in either cubics or biquadratic equations, even when the formulæ involve no imaginary quantities, and therefore can be always applied, it is more convenient in practice to employ some other methods which we are hereafter to explain.

SECT. XIII. Of Reciprocal Equations.

218. ALTHOUGH no general resolution has hitherto been given of equations belonging to the fifth, or any higher degree; yet there are particular equations of all orders, which, by reason of certain peculiarities in the nature of their roots, admit of being reduced to others of a lower degree, and thus, in some cases, equations of the higher orders may be resolved by the rules which have been already explained for the resolution of equations belonging to the first four orders.

219. When the coefficients of the terms of an equation form the same numerical series, whether taken in a direct or an inverted order, as in this example,

$$x^6 + px^3 + qx^3 + px + 1 = 0,$$

that equation may always be transformed into another of a degree denoted by half the exponent of the highest power of the unknown quantity, if that exponent be an even number, or by half the exponent diminished by unity, if it be an odd number.

The same observation will also apply to any equation of this form,

$$x^4 + pax^2 + qa^2x^2 + pa^3x + a^4 = 0,$$

where the given quantity a and the unknown quantity x are

Reciprocal Equations.

Reciprocal x are precisely alike concerned; for by substituting ay Equations. for x , it becomes

$$a^4y^4 + pa^4y^3 + qa^4y^2 + pa^4y + a^4 = 0;$$

and dividing by a^4 ,

$$y^4 + py^3 + qy^2 + py + 1 = 0,$$

an equation of the same kind as the former.

220. That we may effect the proposed transformation upon the equation

$$x^4 + px^3 + qx^2 + px + 1 = 0;$$

let every two terms which are equally distant from the extremes be collected into one, and the whole be divided by x^2 , thus we have

$$x^2 + \frac{1}{x^2} + p\left(x + \frac{1}{x}\right) + q = 0.$$

Let us assume $x + \frac{1}{x} = z$.

Then $x^2 + 2 + \frac{1}{x^2} = z^2$ and $x^2 + \frac{1}{x^2} = z^2 - 2$.

Thus the equation $x^2 + \frac{1}{x^2} + p\left(x + \frac{1}{x}\right) + q = 0$

becomes $z^2 + pz + q - 2 = 0$.

And since $x + \frac{1}{x} = z$, therefore $x^2 - zx + 1 = 0$.

221. Hence, upon the whole, to determine the roots of the biquadratic equation

$$x^4 + px^3 + qx^2 + px + 1 = 0,$$

we have the following rule.

Form this quadratic equation,

$$z^2 + pz + q - 2 = 0,$$

and find its roots, which let us suppose denoted by z' and z'' . Then the four roots of the proposed equation will be found by resolving two quadratic equations

$$x^2 - z'x + 1 = 0, \quad x^2 - z''x + 1 = 0.$$

222. It may be observed respecting these two quadratic equations, that since the last term of each is unity, if we put a, a' to denote the roots of the one, and b, b' those of the other, we have from the theory of equations $aa' = 1$, and therefore $a' = \frac{1}{a}$, also $bb' = 1$, and $b' = \frac{1}{b}$; now a, a', b, b' are also the roots of the equation

$$x^4 + px^3 + qx^2 + px + 1 = 0.$$

Hence it appears that the proposed equation has this peculiar property, that the one half of its roots are the reciprocals of the other half; and to that circumstance we are indebted for the simplicity of its resolution.

223. The following equation,

$$x^6 + px^5 + qx^4 + rx^3 + px^2 + qx + 1 = 0,$$

which is of the sixth order, admits of a resolution in all respects similar to the former; for by putting it under this form

$$x^3 + \frac{1}{x^3} + p\left(x^2 + \frac{1}{x^2}\right) + q\left(x + \frac{1}{x}\right) + r = 0,$$

and putting also $x + \frac{1}{x} = z$, so that $x^2 - zx + 1 = 0$, we

have $x^2 + \frac{1}{x^2} = z^2 - 2$

$$x^3 + \frac{1}{x^3} = z^3 - 3\left(x + \frac{1}{x}\right) = z^3 - 3z.$$

Hence, by substitution, the proposed equation is transformed into the following cubic equation

$$z^3 + pz^2 + (q-3)z + r - 2p = 0.$$

Therefore, putting z', z'', z''' , to denote its roots, the six roots of the proposed equation will be had by resolving these three quadratics

$$x^2 - z'x + 1 = 0, \quad x^2 - z''x + 1 = 0, \quad x^2 - z'''x + 1 = 0,$$

and here it is evident, as in the former case, that the roots of each quadratic equation are the reciprocals of each other, so that the one half of the roots of the proposed equation are the reciprocals of the other half.

224. The method of resolution we have employed in the two preceding examples is general for all equations whatever, in which the terms placed at equal distances from the first and last have the same coefficients, and which are called *reciprocal equations*, because any such equation has the same form when you substitute

for x its reciprocal $\frac{1}{x}$.

225. If the greatest exponent of the unknown quantity in a reciprocal equation is an odd number, as in this example,

$$x^5 + px^4 + qx^3 + qx^2 + px + 1 = 0,$$

the equation will always be satisfied by substituting -1 for x ; hence -1 must be a root of the equation, and therefore the equation must be divisible by $x + 1$. Accordingly, if the division be actually performed, we shall have in the present case

$$x^4 + (p-1)x^3 - (p-q-1)x^2 + (p-1)x + 1 = 0,$$

another reciprocal equation, in which the greatest exponent of x is an even number, and therefore resolvable in the manner we have already explained.

SECT. XIV. Of Equations which have Equal Roots.

226. WHEN an equation has two or more of its roots equal to one another, those roots may always be discovered, and the equation reduced to another of an inferior degree, by a method of resolution which is peculiar to this class of equations; and which we now proceed to explain.

227. Although the method of resolution we are to employ will apply alike to equations having equal roots, of every degree, yet, for the sake of brevity, we shall take a biquadratic equation,

$$x^4 + px^3 + qx^2 + rx + s = 0,$$

the roots of which may be generally denoted by a, b, c , and d . Thus we have, from the theory of equations,

$$(x-a)(x-b)(x-c)(x-d) = x^4 + px^3 + qx^2 + rx + s.$$

Let us put

$$A = (x-a)(x-b)(x-c) \quad A'' = (x-a)(x-c)(x-d) \\ A' = (x-a)(x-b)(x-d) \quad A''' = (x-b)(x-c)(x-d)$$

Then,

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Then, by actual multiplication, we have

$$\begin{aligned} A &= x^3 - a \left\{ \begin{array}{l} +ab \\ -b \\ -c \end{array} \right\} x^2 + \left\{ \begin{array}{l} +ac \\ +bc \end{array} \right\} x - abc \\ A' &= x^3 - a \left\{ \begin{array}{l} +ab \\ -b \\ -d \end{array} \right\} x^2 + \left\{ \begin{array}{l} +ad \\ +bd \end{array} \right\} x - abd \\ A'' &= x^3 - a \left\{ \begin{array}{l} +ac \\ -c \\ -d \end{array} \right\} x^2 + \left\{ \begin{array}{l} +ad \\ +bd \end{array} \right\} x - acd \\ A''' &= x^3 - b \left\{ \begin{array}{l} +bc \\ -c \\ -d \end{array} \right\} x^2 + \left\{ \begin{array}{l} +bd \\ +cd \end{array} \right\} x - bcd \end{aligned}$$

and taking the sum of these four equations

$$\begin{aligned} A + A' + A'' + A''' &= 4x^3 - 3a \left\{ \begin{array}{l} +2ab \\ -3b \\ -3c \\ -3d \end{array} \right\} x^2 + \left\{ \begin{array}{l} +2ac \\ +2ad \\ +2bc \\ +2bd \\ +2cd \end{array} \right\} x - abc - abd - acd - bcd \end{aligned}$$

But since a, b, c, d are the roots of the equation

$$x^4 + px^3 + qx^2 + rx + s = 0,$$

$$\begin{aligned} \text{we have } -3(a+b+c+d) &= 3p \\ 2(ab+ac+ad+bc+bd+cd) &= 2q \\ -(abc+abd+acd+bcd) &= r. \end{aligned}$$

Therefore, by substitution,

$$A + A' + A'' + A''' = 4x^3 + 3px^2 + 2qx + r.$$

228. Let us now suppose that the proposed biquadratic equation has two equal roots, or $a=b$, then $x=a=x=b$, and since one or other of these equal factors enters each of the four products A, A', A'', A''' , it is evident that $A + A' + A'' + A'''$, or $4x^3 + 3px^2 + 2qx + r$ must be divisible by $x-a$, or $x-b$. Thus it appears that if the proposed equation

$$x^4 + px^3 + qx^2 + rx + s = 0$$

has two equal roots, each of them must also be a root of this equation,

$$4x^3 + 3px^2 + 2qx + r = 0;$$

for when the first of these equations is divisible by $(x-a)^2$, the latter is necessarily divisible by $x-a$.

229. Let us next suppose that the proposed equation has three equal roots or $a=b=c$, then two at least of the three equal factors $x-a, x-b, x-c$, must enter each of the four products A^0, A', A'', A''' ; so that in this case $A + A' + A'' + A'''$, or $4x^3 + 3px^2 + 2qx + r$ must be twice divisible by $x-a$. Hence it follows, that as often as the proposed equation has three equal roots, two of them must also be equal roots of the equation

$$4x^3 + 3px^2 + 2qx + r = 0.$$

230. Proceeding in the same manner, it may be shewn that whatever number of equal roots are in the proposed equation

$$x^4 + px^3 + qx^2 + rx + s = 0,$$

they will all remain except one, in this equation

$$4x^3 + 3px^2 + 2qx + r = 0,$$

which is evidently derived from the former, by multiplying each of its terms by the exponent of x in that term, and then diminishing the exponent by unity.

231. If we suppose that the proposed equation has two equal roots or $a=b$, and also two other equal roots, or $c=d$, then, by reasoning as before, it will appear that the equation derived from it must have one root equal to a or b , and another equal to c or d ; so that when the former is divisible both by $(x-a)^2$ and $(x-c)^2$, the latter will be divisible by $(x-a)(x-c)$.

232. The same mode of reasoning may be extended to all equations whatever; so that if we suppose

$$x^m + Px^{m-1} + Qx^{m-2} + \dots + Sx^2 + Tx + U = 0,$$

an equation of the m th degree, to have a divisor of this form,

$$(x-a)^n (x-d)^p (x-f)^q \dots \&c.$$

The equation

$$mx^{m-1} + (m-1)Px^{m-2} + (m-2)Qx^{m-3} + \dots + 2Sx + T = 0,$$

which is of the next lower degree, will have for a divisor

$$(x-a)^{n-1} (x-d)^{p-1} (x-f)^{q-1} \dots \&c.$$

and as this last product must be a divisor of both equations, it may always be discovered by the rule which has been given (§ 49.) for finding the greatest common divisor of two algebraic quantities.

233. Again, as this last equation must, in the case of equal roots, have the same properties as the original equation; therefore, if we multiply each of its terms by the exponent of x , and diminish that exponent by unity, as before, we have

$$m(m-1)x^{m-2} + (m-1)(m-2)Px^{m-3} + (m-2)(m-3)Qx^{m-4} + \dots + 2S = 0,$$

a new equation, which will have for a divisor

$$(x-a)^{n-2} (x-d)^{p-2} (x-f)^{q-2},$$

where the exponent of the factors are one less than those of the equation from which it was derived; and as this last divisor is also a divisor of the original equation, it may be discovered in the same manner as the former, namely, by finding the greatest common measure of both equations; and so on we may proceed as far as we please.

234. As a particular example, let us take this equation,

$$x^5 - 13x^4 + 67x^3 - 171x^2 + 216x - 108 = 0,$$

and apply to it the method we have explained, in order to discover whether it has equal roots, and if so, what they are. We must therefore seek the greatest common measure of the proposed equation and this other equation, which is formed agreeably to what has been shewn § 228,

$$5x^4 - 52x^3 + 201x^2 - 342x + 216 = 0,$$

and the operation being performed, we find that they have a common divisor $x^3 - 8x^2 + 21x - 18$, which is of the third degree, and consequently may have several factors. Let us therefore try whether the last equation and the following,

$$20x^3 - 156x^2 + 402x - 342 = 0,$$

which is derived from it, as directed in § 228. have any common divisor; and, by proceeding as before, we

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Roots.

find that they admit of this divisor $x-3$, which is also a factor of the last divisor $x^3-8x^2+21x-18$, and therefore the product of remaining factors is immediately found by division to be x^2-5x+6 , which is evidently resolvable into $x-2$ and $x-3$.

Thus, it appears upon the whole, that the common divisor of the original equation, and that which is immediately derived from it, is $(x-2)(x-3)^2$; and that the common divisor of the second and third equations is $x-3$. Hence it follows that the proposed equation has $(x-2)^2$ for one factor, and $(x-3)^3$ for another factor; so that the equation itself may be expressed thus, $(x-2)^2(x-3)^3=0$, and the truth of this conclusion may be easily verified by multiplication.

SECT. XV. Resolution of Equations whose Roots are rational.

235. It has been shewn in § 169 that the last term of any equation is always the product of its roots taken with contrary signs: Hence it follows that when the roots are rational they may be discovered by the following rule.

Bring all the terms of the equation to one side; find all the divisors of the last term, and substitute them successively for the unknown quantity in the equation. Then each divisor, which produces a result equal to 0, is a root of the proposed equation.

Ex. 1. Let $x^3-4x^2-7x+10=0$ be the proposed equation.

Then, the divisors of 10 the last term are 1, 2, 5, 10, each of which may be taken either positively, or negatively, and these being substituted successively for x , we obtain the following results.

By putting +1 for x ,	1—	4—	7+10=	0
—1	—1—	4+	7+10=	12
+2	8—	16—	14+10=	—12
—2	—8—	16+	14+10=	0
+5	125—	100—	35+10=	0

Here the divisors which produce results equal to 0 are +1, —2, and +5, and therefore these numbers are the three roots of the proposed equation.

236. When the number of divisors to be tried happens to be considerable, it will be convenient to transform the proposed equation into another, in which the last term has fewer divisors. This may, in general, be done by forming an equation, the roots of which are greater or less than those of the proposed equation by some determinate quantity, as in the following example:

Ex. 2. Let $y^4-4y^3-8y+32=0$ be proposed.

Here the divisors to be tried are 1, 2, 4, 8, 16, 32, each taken either positively or negatively; but to prevent the trouble of so many substitutions, let us transform the equation, by putting $x+1$ for y .

$$\begin{array}{rcl} \text{Then } y^4 & = & x^4 + 4x^3 + 6x^2 + 4x + 1 \\ -4y^3 & = & -4x^3 - 12x^2 - 12x - 4 \\ -8y & = & -8x - 8 \\ +32 & = & +32 \end{array}$$

$$\text{Therefore } x^4 - 6x^2 - 16x + 21 = 0$$

is the transformed equation, and the divisors of the last term are +1, —1, +3, —3, +7, —7. These being put successively for x , we get +1 and +3 for two roots of the equation; and as to the two remaining roots, it is easy to see that they must be imaginary. They may, however, be readily exhibited by considering that the equation $x^4-6x^2-16x+21=0$ is divisible by the product of the two factors $x-1$ and $x-3$, and therefore may be reduced to a quadratic. Accordingly, by performing the division, and putting the quotient equal 0, we have this equation,

$$x^2+4x+7=0,$$

the roots of which are the imaginary quantities $-2+\sqrt{-3}$ and $-2-\sqrt{-3}$; so that since $y=x+1$, the roots of the equation $y^4-4y^3-8y+32=0$ are these, $y=+2$, $y=+4$, $y=-1+\sqrt{-3}$, $y=-1-\sqrt{-3}$.

If this literal equation were proposed,

$$x^3-(3a+b)x^2+(2a^2+3ab)x-2a^2b=0,$$

by proceeding as before, we should find $x=a$, $x=2a$, $x=b$ for the roots.

237. To avoid the trouble of trying all the divisors of the last term, a rule may be investigated for restricting the number to very narrow limits, as follows:

Suppose that the cubic equation $x^3+px^2+qx+r=0$ is to be resolved. Let it be transformed into another, the roots of which are less than those of the proposed equation by unity: this may be done by assuming $y=x-1$, and the last term of the transformed equation will be $1+p+q+r$. Again, by assuming $y=x+1$ another equation will be formed whose roots exceed those of the proposed equation by unity, and the last term of this other transformed equation will be $-1+p-q+r$. And here it is to be observed, that these two quantities $1+p+q+r$ and $-1+p-q+r$ are formed from the proposed equation x^3+px^2+qx+r by substituting in it successively +1 and —1 for x .

Now the values of x are some of the divisors of r , which is the term left in the proposed equation, when x is supposed $=0$; and the values of the y 's are some of the divisors of $1+p+q+r$ and $-1+p-q+r$ respectively; and these values are in arithmetical progression, increasing by the common difference unity; because $x-1$, x , $x+1$ are in that progression; and it is obvious, that the same reasoning will apply to an equation of any degree whatever. Hence the following rule.

Substitute in place of the unknown quantity, successively, three or more terms of the progression 1, 0, —1, &c. and find all the divisors of the sums that result, then take out all the arithmetical progressions that can be found among these divisors, whose common difference is 1, and the values of x will be among these terms of the progressions, which are the divisors of the result arising from the substitution of $x=0$. When the series increases, the roots will be positive; and, when it decreases, they will be negative.

Ex. 1. Let it be required to find a root of the equation $x^3-x^2-10x+6=0$.

The

Equations
with ratio-
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Equations
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The operation.

Substit.	Result.	Divisors.	Ar. Pro.
$x = +1$	$x^3 - x^2 - 10x + 6 =$	1. 2. 4.	4
$x = 0$		1. 2. 3. 6.	3
$x = -1$		1. 2. 7. 14.	2

In this example there is only one progression, 4, 3, 2, the term of which opposite to the supposition of $x=0$ being 3, and the series decreasing, we try if -3 substituted for x makes the equation vanish, and as it succeeds, it follows that -3 is one of its roots. To find the remaining roots, if $x^3 - x^2 - 10x + 6$ be divided by $x+3$, and the quotient $x^2 - 4x + 2$ put $=0$, they will appear to be $2+\sqrt{2}$, and $2-\sqrt{2}$.

Ex. 2. Let the proposed equation be

$$x^4 + x^3 - 29x^2 - 9x + 180 = 0.$$

To find its roots.

Sub.	Res.	Divisors.	Progressions.
2	70	1. 2. 5. 7. 10. 14. 35. 70.	1 2 5 7
1	144	1. 2. 3. 4. 6. 8. 9. 12, &c.	2 3 4 6
0	180	1. 2. 3. 4. 5. 6. 9. 10, &c.	3 4 3 5
-1	160	1. 2. 4. 5. 8. 10. 16. 20, &c.	4 5 2 4
-2	90	1. 2. 3. 5. 6. 9. 10. 15, &c.	5 6 1 3

Here there are four progressions, two increasing and two decreasing; hence by taking their terms, which are opposite to the supposition of $x=0$, we have these four numbers to be tried as roots of the equation $+3, +4, -3, -5$, all of which are found to succeed.

238. If any of the coefficients of the proposed equation be a fraction, the equation may be transformed into another, having the coefficient of the highest power unity, and those of the remaining terms integers by § 189. and the roots of the transformed equation being found, those of the proposed equation may be easily derived from them.

For example, if the proposed equation be $x^3 - \frac{7}{4}x^2 + \frac{35}{4}x - 6 = 0$. Let us assume $x = \frac{y}{4}$, thus the equation is transformed to

$$\frac{y^3}{64} - \frac{7y^2}{64} + \frac{35y}{16} - 6 = 0,$$

$$\text{Or } y^3 - 7y^2 + 140y - 384 = 0,$$

one root of which is $y=3$; hence $x = \frac{y}{4} = \frac{3}{4}$.

The proposed equation being now divided by $x - \frac{3}{4}$ is reduced to this quadratic $x^2 - x + 8 = 0$, the roots of which are both impossible.

239. When the coefficients of an equation are integers, and that of the highest power of the unknown quantity unity, if its roots are not found among the divisors of the last term, we may be certain that, whether the equation be pure or affected, its roots cannot be exactly expressed either by whole numbers or ratio-

nal fractions. This may be demonstrated by means of the following proposition. If a prime number P be a divisor of the product of two numbers A and B, it will also be a divisor of at least one of the numbers.

240. Let us suppose that it does not divide B, and that B is greater than P; then, putting q for the greatest number of times that P can be had in B, and B' for the remainder, we have $\frac{B}{P} = q + \frac{B'}{P}$, and therefore

$$\frac{AB}{P} = qA + \frac{AB'}{P}.$$

Hence it appears, that if P be a divisor of AB, it is also a divisor of AB'. Now B' is less than P, for it is the remainder which is found in dividing B by P; therefore, seeing we cannot divide B' by P, let P be divided by B', and q' put for the quotient, also B'' for the remainder; again, let P be divided by B'', and q'' put for the quotient, and B''' for the remainder, and so on; and as P is supposed to be a prime number, it is evident that this series of operations may be continued till the remainder be found equal to unity, which will at last be the case; for the divisors are the successive remainders of the divisions, and therefore each is less than the divisor which preceded it. By performing these operations we obtain the following series of equations,

$$\left. \begin{aligned} P &= q'B' + B'' \\ P &= q''B'' + B''' \\ &\&c. \end{aligned} \right\} \text{ and therefore } \left\{ \begin{aligned} B' &= \frac{P - B''}{q'} \\ B'' &= \frac{P - B'''}{q''} \\ &\&c. \end{aligned} \right.$$

Hence we have $AB' = \frac{AP - AB''}{q'}$, and

$$\frac{q'AB'}{P} = \frac{AP - AB''}{P} = A - \frac{AB''}{P}.$$

Now if AB be divisible by P, we have shewn that AB', and consequently $q'AB'$ is divisible by P; therefore, from the last equation, it appears that AB'' must also be divisible by P.

Again, from the preceding series of equations, we have $AB'' = \frac{AP - AB'''}{q''}$, and therefore

$$\frac{q''AB''}{P} = \frac{AP - AB'''}{P} = A - \frac{AB'''}{P};$$

hence we conclude that AB''' is also divisible by P.

Proceeding in this manner, and observing that the series of quantities B', B'', B''', &c. continually decrease till one of them $=1$, it is evident that we shall at last come to a product of this form $A \times 1$, which must

Equations must be divisible by P, and hence the truth of the proposition is manifest.

241. It follows from this proposition, that if the prime number P, which we have supposed not to be a divisor of B, is at the same time not a divisor of A, it cannot be a divisor of AB the product of A and B.

242. Let $\frac{b}{a}$ be a fraction in its lowest terms, then the numbers a and b have no common divisor; but from what has been just now shewn, it appears, that if a prime number be not a divisor of a it cannot be a divisor of $a \times a$ or a^2 , and in like manner, that if a prime number is not a divisor of b , it cannot be a divisor of $b \times b$, or b^2 ; therefore, it is evident that a^2 and b^2 have no common divisor, and thus the fraction $\frac{b^2}{a^2}$ is also in its lowest terms.

Hence it follows that the square of any fractional quantity is still a fraction, and cannot possibly be a whole number; and, on the contrary, that the square root of a whole number cannot possibly be a fraction; so that all such whole numbers as are not perfect squares can neither have their roots expressed by integers nor by fractions.

243. Since then if a prime number is not a divisor of a , it is also not a divisor of a^2 , therefore if it is not a divisor of a , it cannot be a divisor of $a \times a^2$ or a^3 , § 241, and by reasoning in this way, it is obvious that if a prime number is not a divisor of a , it cannot be a divisor of a^n ; also, that if it is not a divisor of b , it cannot be a divisor of b^n , therefore if $\frac{b}{a}$ is a fraction in its

lowest terms, $\frac{b^n}{a^n}$ is also a fraction in its lowest terms; so that any power whatever of a fraction is also a fraction, and on the contrary, any root of a whole number is also a whole number. Hence it follows that if the root of a whole number is not expressible by an integer, such root cannot be expressed by a fraction, but is therefore irrational or incommensurable.

244. Let us next suppose that

$$x^n + Px^{n-1} + Qx^{n-2} \dots + Tx + U = 0$$

is any equation whatever, in which P, Q, &c. denote integer numbers; then if its roots are not integers they cannot possibly be rational fractions. For, if possible,

let us suppose $x = \frac{b}{a}$, a fraction reduced to its lowest terms, then, by substitution,

$$\frac{a^n}{b^n} + P \frac{a^{n-1}}{b^{n-1}} + Q \frac{a^{n-2}}{b^{n-2}} \dots + T \frac{a}{b} + U = 0,$$

and, reducing all the terms to a common denominator,

$$a^n + Pa^{n-1}b + Qa^{n-2}b^2 \dots + Tab^{n-1} + Ub^n = 0,$$

which equation may also be expressed thus,

$$a^n + b(Pa^{n-1} + Qa^{n-2}b \dots + Tab^{n-2} + Ub^{n-1}) = 0,$$

where the equation consists of two parts, one of which is divisible by b . But by hypothesis a and b have no common measure, therefore a^n is not divisible by b , § 243; hence it is evident that the two parts of the equation cannot destroy each other as they ought to do; therefore x cannot possibly be a fraction.

SECT. XVI. Resolution of Equations by Approximation.

Approximation.

245. WHEN the roots of an equation cannot be accurately expressed by rational numbers, it is necessary to have recourse to the methods of approximation, and by these we can always determine the numerical values of the roots to as great a degree of accuracy as we please.

246. The application of the methods of approximation is rendered easy by means of the following principles:

If two numbers, either whole or fractional, be found, which, when substituted for the unknown quantity in any equation, produce results with contrary signs; we may conclude that at least one root of the proposed equation is between those numbers, and is consequently real.

Let the proposed equation be

$$x^3 - 5x^2 + 10x - 15 = 0,$$

which, by collecting the positive terms into one sum, and the negative into another, may also be expressed thus,

$$x^3 + 10x - (5x^2 + 15) = 0;$$

then to determine a root of the equation, we must find such a number as when substituted for x will render

$$x^3 + 10x = 5x^2 + 15.$$

Let us suppose x to have every degree of magnitude from 0 upwards in the scale of number, then $x^3 + 10x$ and $5x^2 + 15$ will both continually increase, but with different degrees of quickness, as appears from the following table.

Successive values of x . 0, 1, 2, 3, 4, 5, 6, &c.
 — of $x^3 + 10x$. 0, 11, 28, 57, 104, 175, 276, &c.
 — of $5x^2 + 15$. 15, 20, 35, 60, 95, 140, 195, &c.

By inspecting this table, it appears that while x increases from 0 to a certain numerical value, which exceeds 3, the positive part of the equation, or $x^3 + 10x$, is always less than the negative part, or $5x^2 + 15$; so that the expression

$$x^3 + 10x - (5x^2 + 15), \text{ or } x^3 - 5x^2 + 10x - 15$$

must necessarily be negative.

It also appears that when x has increased beyond that numerical value, and which is evidently less than 4, the positive part of the equation, instead of being less than the negative part, is now greater, and therefore the expression

$$x^3 - 5x^2 + 10x - 15$$

is changed from a negative to a positive quantity.

247. Hence we may conclude that there is some real and determinate value of x , which is greater than 3, but less than 4, and which will render the positive and negative parts of the equation equal to one another; therefore that value of x must be a root of the proposed equation; and as what has been just now shewn in a particular case will readily apply to any equation whatever, the truth of what has been asserted at § 246 is obvious.

Approximation.

Approximation.

248. Two limits, between which all the roots of any equation are contained, may be determined by the following proposition.

Let N be the greatest negative coefficient in any equation. Change the signs of the terms taken alternately, beginning with the second, and let N' be the greatest negative coefficient after the signs are so changed. The positive roots of the equation are contained between 0 and $N+1$, and the negative roots between 0 and $-N'-1$.

Suppose the equation to be

$$x^4 - px^3 + qx^2 - rx - s = 0,$$

which may be also expressed thus :

$$x^4 \left(1 - \frac{p}{x} + \frac{q}{x^2} - \frac{r}{x^3} - \frac{s}{x^4} \right) = 0.$$

Then, whatever be the values of the coefficients p, q, r , &c. it is evident that x may be taken so great as to render each of the quantities $\frac{p}{x}, \frac{q}{x^2}, \frac{r}{x^3}, \frac{s}{x^4}$ as small as we

please, and therefore their sum, or $-\frac{p}{x} + \frac{q}{x^2} - \frac{r}{x^3} - \frac{s}{x^4}$ less than 1; but in that case the quantity

$$x^4 \left(1 - \frac{p}{x} + \frac{q}{x^2} - \frac{r}{x^3} + \frac{s}{x^4} \right),$$

$$\text{or } x^4 - px^3 + qx^2 - rx + s,$$

will be positive, and such, that the first term x^4 is greater than the sum of all the remaining terms; therefore also $x^4 + qx^2$ the sum of the positive terms will be much greater than $px^3 + rx + s$ the sum of the negative terms alone.

Hence it follows, that if a number be found, which when substituted for x , renders the expression $x^4 - px^3 + qx^2 - rx - s$ positive, and which is also such that every greater number has the same property, that number will exceed the greatest positive root of the equation.

Now, if we suppose N to be the greatest negative coefficient, it is evident that the positive part of the equation, or $x^4 + qx^2$, is greater than $px^3 + rx + s$, provided that x^4 is greater than $Nx^3 + Nx^2 + Nx + N$, or $N(x^3 + x^2 + x + 1)$; but $x^3 + x^2 + x + 1 = \frac{x^4 - 1}{x - 1}$, therefore a positive result will be obtained, if for x there be substituted a number such that $x^4 > \frac{N(x^4 - 1)}{x - 1}$, or $x^5 - x^4 > Nx^4 - N$. Now this last condition will evidently be fulfilled if we take $x^5 - x^4 = Nx^4$, and from this equation we find $x = N + 1$; but it farther appears that the same condition will also be fulfilled as often as $x^5 - x^4 > Nx^4$, or $x - 1 > N$, that is, $x > N + 1$, therefore $N + 1$ must be a limit to the greatest positive root of the proposed equation, as was to be shewn.

249. If $-y$ be substituted for $+x$, the equation $x^4 - px^3 + qx^2 - rx - s = 0$ will be transformed into $y^4 + py^3 + qy^2 + ry - s = 0$; which equation differs from

the former only in the signs of the second, fourth, &c. terms; and as the positive roots of this last equation are the same as the negative roots of the proposed equation, it is evident that their limit must be such as has been assigned.

250. From the two preceding propositions it will not be difficult to discover, by means of a few trials, the nearest integers to the roots of any proposed numeral equation, and those being found, we may approximate to the roots continually, as in the following example :

$$x^4 - 4x^3 - 3x + 27 = 0.$$

Here the greatest negative coefficient being 4, it follows, § 248. that the greatest positive root is less than 5. If $-y$ be substituted for x , the equation is transformed to

$$y^4 + 4y^3 + 3y + 27 = 0,$$

an equation having all its terms positive; therefore, it can have no positive roots, and consequently the proposed equation can have no negative roots; its real roots must therefore be contained between 0 and +5.

251. To determine the limits of each root in particular, let 0, 1, 2, 3, 4, be substituted successively for x ; thus we obtain the following corresponding results.

Substitutions for x	0,	1,	2,	3,	4
Results	+27,	+21,	+5,	-9,	+15.

Hence it appears that the equation has two real roots, one between 2 and 3, and another between 3 and 4.

252. That we may approximate to the first root, let us suppose $x = 2 + y$, where y is a fraction less than unity, and therefore its second and higher powers but small in comparison to its first power; hence, in finding an approximate value of y , they may be rejected. Thus we have

$$\begin{aligned} x^4 &= +16 + 32y, \text{ \&c.} \\ -4x^3 &= -32 - 48y, \text{ \&c.} \\ -3x &= -6 - 3y \\ +27 &= +27 \end{aligned}$$

$$\text{Hence } 0 = 5 - 19y \text{ nearly,}$$

and $y = \frac{5}{19} = .26$; therefore, for a first approximation, we have $x = 2.26$.

Let us next suppose $x = 2.26 + y'$, then, rejecting as before the second and higher powers of y' on account of their smallness, we have

$$\begin{aligned} x^4 &= +26.087 + 46.172y', \text{ \&c.} \\ -4x^3 &= -46.172 - 61.291y', \text{ \&c.} \\ -3x &= -6.780 - 3y' \\ +27 &= +27 \end{aligned}$$

$$0 = .135 - 18.119y' \text{ nearly.}$$

$$\text{Hence } y' = \frac{.135}{18.119} = .0075, \text{ and } x = 2.26 + y' = 2.2675.$$

This value of x is true to the last figure, but a more accurate value may be obtained by supposing $x = 2.2675 + y''$, and finding the value of y'' in the same manner as we have already found those of y' and y ; and thus the

* The sign $>$ denotes that the quantities between which it is placed are unequal. Thus $a > b$, signifies that a is greater than b , and $a < c$, that a is less than c .

Approximation.

the approximation may be continued till any required degree of accuracy be obtained.

The second root of the equation, which we have already found to be between 3 and 4, may be investigated in the same manner as the first, and will appear to be 3.6797, the approximation being carried on to the fourth figure of the decimal, in determining each root.

253. In the preceding example we have shewn how to approximate to the roots of an affected equation, but the same method will also apply to pure equations.

For example, let it be required to determine x from this equation $x^3 = 2$.

Because x is greater than 1, and less than 2, but nearer to the former number than to the latter, let us assume $x = 1 + y$, then, rejecting the powers of y which exceed the first, we have $x^3 = 1 + 3y$, and therefore $2 = 1 + 3y$, and $y = \frac{1}{3} = .3$ nearly, hence $x = 1.3$ nearly.

Let us next assume $x = 1.3 + y'$ then, proceeding as before, we find $2 = 2.197 + 5.07y'$, hence $y' = -\frac{.197}{5.07} = -.039$, and $x = 1.3 - .039 = 1.26$ nearly.

To find a still nearer approximation, let us suppose $x = 1.26 + y'$, then from this assumption we find $y' = -.000079$, and therefore $x = 1.259921$, which value is true to the last figure.

254. By assuming an equation of any order with literal coefficients, a general formula may be investigated, for approximating to the roots of equations belonging to that particular order.

Let us take for an example the cubic equation

$$x^3 + px^2 + qx + r = 0,$$

and suppose that $x = a + y$, where a is nearly equal to x , and y is a small fraction. Then, by substituting $a + y$ for x in the proposed equation, and rejecting the powers of y which exceed the first, on account of their smallness, we have

$$a^3 + pa^2 + qa + r + (3a^2 + 2pa + q)y = 0.$$

$$\text{Hence } y = -\frac{a^3 + pa^2 + qa + r}{3a^2 + 2pa + q},$$

$$\text{and } x = a - \frac{a^3 + pa^2 + qa + r}{3a^2 + 2pa + q} = \frac{2a^3 + pa^2 - r}{3a^2 + 2pa + q}.$$

255. Let it be required to approximate to a root of the cubic equation $x^3 + 2x^2 + 3x - 50 = 0$. Here $p = 2$, $q = 3$ and $r = -50$; and by trials it appears that x is between 2 and 3, but nearest the latter number; therefore, for the first approximation, a may be supposed $= 3$, hence we find

$$x = \frac{2a^3 + pa^2 - r}{3a^2 + 2pa + q} = \frac{2 \cdot 27 + 4 - (-50)}{3 \cdot 9 + 12 + 3} = \frac{81}{24} = \frac{9}{2}.$$

By substituting $\frac{9}{2}$ for a in the formula, and proceeding as before, a value of x would be found more exact than the former, and so on we may go as far as we please.

256. The method we have hitherto employed for approximating to the roots of equations, is known by the name of the *method of successive substitutions*, and was first proposed by Newton. It has been since improved by Lagrange, who has given it a form which has the ad-

vantage of shewing the progress made in the approximation by each operation. This improved form we now proceed to explain.

Let a denote the whole number, next less to the root sought, and $\frac{1}{y}$ a fraction, which, when added to a ,

completes the root, then $x = a + \frac{1}{y}$. If this value of x

be substituted in the proposed equation, a new equation involving y will be had, which, when cleared of fractions, will necessarily have a root greater than unity.

Let b be the whole number which is next less than that root, then, for a first approximation, we have $x =$

$a + \frac{1}{b}$. But b being only an approximate value of y ,

in the same manner as a is an approximate value of x ,

we may suppose $y = b + \frac{1}{y'}$, then, by substituting $b + \frac{1}{y'}$

for y , we shall have a new equation, involving only y' ,

which must be greater than unity; putting therefore b'

to denote the next whole number less than the root of

the equation involving y' , we have $y = b + \frac{1}{b'} = \frac{bb' + 1}{b'}$, and substituting this value in that of x , the result is

$$x = a + \frac{b}{bb' + 1}$$

for a second approximate value of x .

To find a third value we may take $y' = b' + \frac{1}{y''}$, then

if b'' denote the next whole number less than y'' , we

have $y' = b' + \frac{1}{b''} = \frac{b'b'' + 1}{b''}$, whence

$$y = b + \frac{b'}{b'b'' + 1} = \frac{bb'b'' + b' + b}{b'b'' + 1}, \text{ and}$$

$$x = a + \frac{b'b'' + 1}{bb'b'' + b' + b},$$

and so on to obtain more accurate approximations.

257. We shall apply this method to the following example,

$$x^3 - 7x + 7 = 0.$$

Here the positive roots must be between 0 and 8, let us therefore substitute successively, 0, 1, 2, . . . to 8, and we obtain results as follow:

Substitutions.

0, 1, 2, 3, 4, 5, 6, 7, 8,

Results.

+7, +1, +1, +13, +43, +97, +181, +301, +463;

but as these results have all the same sign, nothing can be concluded respecting the magnitude of the roots from that circumstance alone. It is, however, observable, that while x increases from 0 to 1 the results decrease; but that whatever successive magnitudes x has greater than 2, the results increase; we may therefore reasonably conclude that if the equation have any positive roots they must be between 1 and 2. Accordingly by substituting 1.2, 1.4, 1.6, and 1.8 successively for x , we find these results +.328, -.056, -.104, +.232, and

approximation. and as there are here two changes of the signs, it follows that the equation has two positive roots, one between 1.2 and 1.4, and another between 1.6 and 1.8.

Hence it appears, that to find either value of x , we may assume $x=1+\frac{1}{y}$; thus, by substitution, we have

$$y^3-4y^2+3y+1=0.$$

The limit of the positive root of this last equation is 5, and by substituting 0, 1, 2, 3, 4, successively for y , it will be found to have two, one of which is between 1 and 2, and the other between 2 and 3. Therefore, for a first approximation, we have

$$x=1+\frac{1}{2}, x=1+\frac{1}{3}, \text{ that is, } x=2, x=\frac{2}{3}.$$

To approach nearer to the first value of y , let us take

$$y=1+\frac{1}{y'}, \text{ and therefore}$$

$$y^3-2y^2-y'+1=0.$$

This last equation will be found to have only one real root between 2 and 3, from which it appears, that $y=1+\frac{1}{2}=\frac{3}{2}$, and $x=1+\frac{2}{3}=\frac{5}{3}$.

Let us next suppose $y'=2+\frac{1}{y''}$; hence we find

$$y'^3-3y''^3-4y''-1=0,$$

and from this equation y'' is found to be between 4 and 5. Taking the least limit, we have

$$y'=2+\frac{1}{4}=\frac{9}{4}, y=1+\frac{4}{9}=\frac{13}{9}, x=1+\frac{9}{13}=\frac{22}{13}.$$

It is easy to continue this process by assuming $y''=4+\frac{1}{y'''}$, and so on, as far as may be judged necessary.

We return to the second value of x , which was found $=\frac{2}{3}$ by the first approximation, and which corresponds to $y=2$. Putting $y=2+\frac{1}{y'}$, and substituting this value in the equation $y^3-4y^2+3y+1=0$, which was formerly found, we get

$$y'^3+y'^2-2y'-1=0,$$

this equation, as well as the corresponding equation employed in determining the other value of x , has only one root greater than unity, which root being between 1 and 2, let us take $y'=1$, we thence find

$$y=3, \text{ and } x=1+\frac{1}{3}=\frac{4}{3}.$$

Put $y'=1+\frac{1}{y''}$, and we thence find by substitution

$$y''^3-3y''^2-4y''-1=0,$$

an equation which gives y'' between 4 and 5; hence, as before,

$$y'=\frac{5}{4}, y=\frac{13}{4}, x=\frac{17}{4}.$$

That we may proceed in the approximation, we have only to suppose $y''=4+\frac{1}{y'''}$, and so on. The equation

x^3-7x+7 has also a negative root between -3 and -4 .

-4 , and to find a nearer value we may put $x=-3-\frac{1}{y}$; hence we have $y^3-20y^2-9y-1=0$, and $y>20$, $y<21$; and therefore, for the first approximation, $x=-3-\frac{1}{20}=-\frac{61}{20}$. By putting $y=20+\frac{1}{y'}$, &c. we may obtain successive values of x , each of which will be more exact than that which preceded it.

258. The successive equations which involve $y, y', y'',$ &c. have never more than one root greater than unity, unless that two or more roots of the proposed equation are contained between the limits a , and $a+1$; but when that circumstance has place, as in the preceding example, some one of the equations involving $y, y',$ &c. will have more than one root greater than unity, and from each root a series of equations may be derived, by which we may approximate to the particular roots of the proposed equation contained between the limits a and $a+1$.

SECT. XVII. Of Infinite Series.

259. THE resolving of any proposed quantity into a series, is a problem of considerable importance in the application of algebra to the higher branches of the mathematics; and there are various methods by which it may be performed, suited to the particular forms of the quantities which may become the subject of consideration.

260. Any rational fraction may be resolved into a series, by the common operation of algebraic division, as in the following examples:

Ex. 1. To change $\frac{ax}{a-x}$ into an infinite series.

Operation.

$$\begin{array}{r} (a-x)ax \quad \left(x + \frac{x^2}{a} + \frac{x^3}{a^2} + \frac{x^4}{a^3}, \text{ \&c.} \right. \\ \hline ax - x^2 \\ \quad + x^2 \\ \quad \quad + x^3 - \frac{x^3}{a} \\ \quad \quad \quad \hline \quad \quad \quad + \frac{x^3}{a} \\ \quad \quad \quad \quad + \frac{x^3}{a} - \frac{x^4}{a^2} \\ \quad \quad \quad \quad \quad \hline \quad \quad \quad \quad \quad + \frac{x^4}{a^2} \end{array}$$

Thus it appears, that

$$\frac{ax}{a-x} = x + \frac{x^2}{a} + \frac{x^3}{a^2} + \frac{x^4}{a^3} +, \text{ \&c.}$$

Here the law of the series being evident, the terms may be continued at pleasure.

Ex. 2. It is required to convert $\frac{a^2}{(a+x)^2}$ into an infinite series.

$$\begin{array}{r}
 \text{Infinite Series.} \quad a^2 + 2ax + x^2 \quad \left(1 - \frac{2x}{a} + \frac{3x^2}{a^2} - \frac{4x^3}{a^3} +, \&c.\right) \\
 \hline
 a^2 + 2ax + x^2 \\
 - 2ax - x^2 \\
 \hline
 - 2ax - 4x^2 - \frac{2x^3}{a} \\
 \hline
 + 3x^2 + \frac{2x^3}{a} \\
 \hline
 + 3x^2 + \frac{6x^3}{a} + \frac{3x^4}{a^2} \\
 \hline
 - \frac{4x^3}{a} - \frac{3x^4}{a^2}
 \end{array}$$

Therefore $\frac{a^2}{(a+x)^2} = 1 - \frac{2x}{a} + \frac{3x^2}{a^2} - \frac{4x^3}{a^3} + \frac{5x^4}{a^4} -, \&c.$
the law of continuation being evident.

261. A second method by which algebraic quantities, whether rational or irrational, may be converted

$$\begin{array}{l}
 a^2A + a^2B \} x + a^2C \} x^2 + a^2D \} x^3 + a^2E \} x^4 +, \&c. \} = 0. \\
 -a^3 + aA \} + aB \} + aC \} + aD \} + aE \}
 \end{array}$$

Now the quantities A, B, C, D, &c. being supposed to be entirely independent of any particular value of x , it follows that the whole expression can only be $= 0$, upon the supposition that the terms which multiply the same powers of x are separately $= 0$; for if that were not the case, it would follow that x had a certain determinate relation to the quantities A, B, C, &c. which is contrary to what we have all along supposed. To determine the quantities A, B, C, &c. therefore, we have this series of equations,

$$\begin{array}{ll}
 a^2A - a^2 & = 0 \text{ Hence } A = 1 \\
 a^2B + aA & = 0 \quad B = -\frac{A}{a} = -\frac{1}{a} \\
 a^2C + aB + A & = 0 \quad C = -\frac{B}{a} - \frac{A}{a^2} = 0 \\
 a^2D + aC + B & = 0 \quad D = -\frac{C}{a} - \frac{B}{a^2} = \frac{1}{a^3} \\
 a^2E + aD + C & = 0 \quad E = -\frac{D}{a} - \frac{C}{a^2} = -\frac{1}{a^4} \\
 & \&c. \quad \&c.
 \end{array}$$

Here the law of relation which takes place among the quantities A, B, C, D, &c. is evident, viz. that if P, Q, R, denote any three coefficients which immediately follow each other,

$$a^2R + aQ + P = 0;$$

and from this equation, by means of the coefficients already determined, we find $F = 0$, $G = \frac{1}{a^6}$, $H = -\frac{1}{a^7}$, $K = 0$, &c.

Therefore, resuming the assumed equation, and substituting for A, B, C, &c. their respective values, we have

$$\frac{a^2}{a^2 + ax + x^2} = 1 - \frac{x}{a} + \frac{x^2}{a^2} - \frac{x^3}{a^3} + \frac{x^4}{a^4} - \frac{x^5}{a^5} +, \&c.$$

262. As a second example of the method of indeter-

into series, and which is also of very extensive use in the higher parts of the mathematics, consists in assuming a series with indeterminate coefficients, and having its terms proceeding according to the powers of some quantity contained in the proposed expression.

That we may explain this method, let us suppose that the fraction $\frac{a^2}{a^2 + ax + x^2}$ is to be converted into a series proceeding by the powers of x : we are therefore to assume

$$\frac{a^2}{a^2 + ax + x^2} = A + Bx + Cx^2 + Dx^3 + Ex^4 +, \&c.$$

where A denotes these terms of the series into which x does not at all enter; Bx the terms which contain only the first power of x ; Cx² the terms which contain only the second power, and so on. Let both sides of the equation be multiplied by $a^2 + ax + x^2$, so as to take away the denominator of the fraction, and let the numerator a^2 be transposed to the other side, so that the whole expression may be $= 0$, then

minate coefficients, let it be required to express the square root $a^2 - x^2$ by means of a series. For this purpose we might assume

$$\sqrt{a^2 - x^2} = A + Bx + Cx^2 + Dx^3 + Ex^4 +, \&c.;$$

but as we would find the coefficients of the odd powers of x , each $= 0$, let us rather assume

$$\sqrt{a^2 - x^2} = A + Bx^2 + Cx^4 + Dx^6 +, \&c.$$

then, squaring both sides, and transposing, we have

$$0 = \left\{ \begin{array}{l} A^2 + 2AB \\ -a^2 + 1 \end{array} \right\} x^2 + \left\{ \begin{array}{l} 2AC \\ B^2 \end{array} \right\} x^4 + \left\{ \begin{array}{l} 2AD \\ 2BC \end{array} \right\} x^6 +, \&c.$$

Hence $A^2 - a^2 = 0$ and $A = a$

$$2AB + 1 = 0 \quad B = -\frac{1}{2A} = -\frac{1}{2a}$$

$$2AC + B^2 = 0 \quad C = -\frac{B^2}{2A} = -\frac{1}{8a^3}$$

$$AD + BC = 0 \quad D = -\frac{BC}{A} = -\frac{1}{16a^5}$$

&c. &c.

and substituting for A, B, C, &c. their values

$$\sqrt{a^2 - x^2} = a - \frac{x^2}{2a} - \frac{x^4}{8a^3} - \frac{x^6}{16a^5} -, \&c.$$

This method of resolving a quantity into an infinite series will be found more expeditious than any other, as often as the operations of division and evolution are to be performed at the same time, as in these expressions

$$\frac{1}{\sqrt{a^2 + x^2}}, \text{ or } \frac{\sqrt{a^2 - x^2}}{\sqrt{a^2 + x^2}}.$$

263. The binomial theorem affords a third method of resolving quantities into series; but before we explain this method, it will be proper to shew how the theorem itself may be investigated.

Let $a + x$ be any binomial quantity, which is to be raised

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raised to a power denoted by $\frac{m}{n}$, where m and n denote any numbers either positive or negative. Or because $a+x=a\left(1+\frac{x}{a}\right)$, if we put $\frac{x}{a}=y$, then $(a+x)^{\frac{m}{n}}=a^{\frac{m}{n}}\times(1+y)^{\frac{m}{n}}$; therefore instead of $a+x$ we may consider $1+y$, which is somewhat more simple in its form.

264. By considering some of the first powers of $1+x$, viz.

$$\begin{aligned}(1+x) &= 1+x \\ (1+x)^2 &= 1+2x+x^2 \\ (1+x)^3 &= 1+3x+3x^2+x^3 \\ (1+x)^4 &= 1+4x+6x^2+4x^3+x^4 \\ &\&c.\end{aligned}$$

it appears that the powers of $1+x$ have this form,

$$1+Ax+Bx^2+Cx^3+Dx^4+, \&c.$$

where the coefficients $A, B, C, D, \&c.$ are numbers which are altogether independent of any particular value of x . It also appears that the series cannot contain any negative power of x ; for if any of its terms had this form $\frac{Q}{x^r}$, then the supposition of $x=0$ would render that term indefinitely great, whereas the whole series ought in that case to be reduced to unity.

265. Let us therefore assume

$$(1+y)^{\frac{m}{n}}=1+Ay+By^2+Cy^3+Dy^4+, \&c.$$

Then we have also

$$(1+x)^{\frac{m}{n}}=1+Ax+Bx^2+Cx^3+Dx^4+, \&c.$$

Let us put $(1+y)^{\frac{x}{n}}=u$, $(1+x)^{\frac{x}{n}}=v$, and therefore

$(1+y)^{\frac{m}{n}}=u^m$, $(1+x)^{\frac{m}{n}}=v^m$, then, taking the difference between the two series, we have

$$u^m-v^m=A(y-x)+B(y^2-x^2)+C(y^3-x^3)+D(y^4-x^4)+, \&c.$$

Because $u=1+y$ and $v=1+x$, by subtracting the latter equation from the former, $u^m-v^m=y-x$, hence, and from the last series, we have

$$\frac{u^m-v^m}{y-x}=\frac{A(y-x)}{y-x}+\frac{B(y^2-x^2)}{y-x}+\frac{C(y^3-x^3)}{y-x}+\frac{D(y^4-x^4)}{y-x}+, \&c.$$

266. But every expression of the form u^m-v^m is divisible by $u-v$, when m is a whole number, thus we have.

$$\begin{aligned}u^m-v^m &=(u-v)(u^{m-1}+u^{m-2}v+\dots+uv^{m-2}+v^{m-1}) \\ u^m-v^m &=(u-v)(u^{m-1}+u^{m-2}v+\dots+uv^{m-2}+v^{m-1})\end{aligned}$$

so that if we substitute for $\frac{u^m-v^m}{u-v}$ its value as found

from these equations, and divide each term of the series by the denominator $y-x$, we have

$$\begin{aligned}\frac{u^{m-1}+u^{m-2}v+\dots+uv^{m-2}+v^{m-1}}{u-v} &= \\ A+B(y+x)+C(y^2+yx+x^2)+D(y^3+y^2x+yx^2+x^3)+E(y^4+y^3x+y^2x^2+yx^3+x^4)+, \&c.\end{aligned}$$

Now as this last equation must be true, whatever be the values of y and x , we may suppose $y=x$, but in that case $1+y=1+x$ or $u=v$, and therefore $u=v$. Thus the equation is reduced to

$$\frac{mu^{m-1}}{u-v}=A+2By+3Cy^2+4Dy^3+5Ey^4+, \&c.$$

or to the following :

$$\frac{m}{n}u^m=u^n(A+2By+3Cy^2+4Dy^3+5Ey^4+, \&c.);$$

so that, putting for u^m and u^n their values $(1+y)^{\frac{m}{n}}$ and $1+y$, we have

$$\begin{aligned}\frac{m}{n}(1+y)^{\frac{m}{n}} &= (1+y)(A+2By+3Cy^2+4Dy^3+5Ey^4+, \&c.) \\ &= \left\{ \begin{array}{l} A+2By+3Cy^2+4Dy^3+5Ey^4+, \&c. \\ + Ay+2By^2+3Cy^3+4Dy^4+, \&c. \end{array} \right.\end{aligned}$$

But from the equation originally assumed we have

$$\frac{m}{n}(1+y)^{\frac{m}{n}}=\frac{m}{n}+\frac{m}{n}Ay+\frac{m}{n}By^2+\frac{m}{n}Cy^3+\frac{m}{n}Dy^4+, \&c.$$

therefore

$$\begin{aligned}\frac{m}{n}+\frac{m}{n}Ay+\frac{m}{n}By^2+\frac{m}{n}Cy^3+\frac{m}{n}Dy^4+, \&c. \\ = \left\{ \begin{array}{l} A+2By+3Cy^2+4Dy^3+5Ey^4+, \&c. \\ + Ay+2By^2+3Cy^3+4Dy^4+, \&c. \end{array} \right.\end{aligned}$$

And as the coefficients of the terms have no connexion with any particular value of y , it follows, that the coefficient of any power of y on the one side of the equation must be equal to the coefficient of the same power

of y on the other side. Therefore, to determine $A, B, C, \&c.$ we have the following series of equations :

Infinite Series.

Infinite Series.

$$A = \frac{m}{n}$$

$$\text{Hence } A = \frac{m}{n}$$

$$2B + A = \frac{m}{n} A$$

$$B = \frac{A\left(\frac{m}{n} - 1\right)}{2} = \frac{A(m-n)}{2n}$$

$$3C + 2B = \frac{m}{n} B$$

$$C = \frac{B\left(\frac{m}{n} - 2\right)}{3} = \frac{B(m-2n)}{3n}$$

$$4D + 3C = \frac{m}{n} C$$

$$D = \frac{C\left(\frac{m}{n} - 3\right)}{4} = \frac{C(m-3n)}{4n}$$

$$5E + 4D = \frac{m}{n} D$$

$$E = \frac{D\left(\frac{m}{n} - 4\right)}{5} = \frac{D(m-4n)}{5n}$$

&c.

&c.

Or, substituting for A, B, C, &c. their values as determined from the preceding equations :

$$A = \frac{m}{n}$$

$$B = \frac{m(m-n)}{1 \cdot 2 n^2}$$

$$C = \frac{m(m-n)(m-2n)}{1 \cdot 2 \cdot 3 n^3}$$

$$D = \frac{m(m-n)(m-2n)(m-3n)}{1 \cdot 2 \cdot 3 \cdot 4 n^4}$$

$$E = \frac{m(m-n)(m-2n)(m-3n)(m-4n)}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 n^5}$$

&c.

267. Resuming now the assumed equation

$$(1+y)^{\frac{m}{n}} = 1 + Ay + By^2 + Cy^3 +, \text{ \&c.}$$

and observing that $\frac{x}{y} = y$ and $(a+x)^{\frac{m}{n}} = a^{\frac{m}{n}} (1+y)^{\frac{m}{n}}$

we have

$$(a+x)^{\frac{m}{n}} = a^{\frac{m}{n}} \left(1 + \frac{mx}{na} + \frac{A(m-n)x^2}{2n a^2} + \frac{B(m-2n)x^3}{3n a^3} + \frac{C(m-3n)x^4}{4n a^4} +, \text{ \&c.} \right)$$

where A, B, C, &c. denote the coefficients of the preceding terms, or

$$(a+x)^{\frac{m}{n}} = a^{\frac{m}{n}} + \frac{m}{n} a^{\frac{m-n}{n}} x + \frac{m(m-n)}{1 \cdot 2 n^2} a^{\frac{m-2n}{n}} x^2 +$$

$$\frac{m(m-n)(m-2n)}{1 \cdot 2 \cdot 3 n^3} a^{\frac{m-3n}{n}} x^3 +$$

$$+ \frac{m(m-n)(m-2n)(m-3n)}{1 \cdot 2 \cdot 3 \cdot 4 n^4} a^{\frac{m-4n}{n}} x^4 +, \text{ \&c.}$$

and either of these formulæ may be considered as a general theorem for raising a binomial quantity $a+x$ to any power whatever.

268. In determining the value of the expression $\frac{u^m - v^m}{u^n - v^n}$ when $u=v$, it has been taken for granted that

$\frac{m}{n}$ is positive, but the same conclusion will be obtain-

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ed when $\frac{m}{n}$ is negative. For, changing $+m$ into $-m$, and observing that

$$u^{-m} - v^{-m} = \frac{1}{u^m} - \frac{1}{v^m} = \frac{v^m - u^m}{u^m v^m}$$

we have

$$\frac{u^{-m} - v^{-m}}{u^n - v^n} = \frac{1}{u^m v^m} \left(\frac{v^m - u^m}{u^n - v^n} \right) = - \frac{1}{u^m v^m} \left(\frac{u^m - v^m}{u^n - v^n} \right).$$

Now we have already found, that when $u=v$, the fraction $\frac{u^m - v^m}{u^n - v^n}$ becomes $\frac{mu^{m-1}}{nu^{n-1}}$; therefore, in the same case,

$$\frac{u^{-m} - v^{-m}}{u^n - v^n} = - \frac{1}{u^m} \times \frac{mu^{m-1}}{nu^{n-1}} = - \frac{u^{-m-1}}{nu^{n-1}}$$

and from this last expression we derive the same value

for u^{-m} or $(1+y)^{-\frac{m}{n}}$ as before, regard being had to the change of the sign of the exponent.

269. If we suppose m to be a positive integer, and $n=1$, the series given in last article for the powers of $a+x$ will always terminate, as appears also from the operation of involution; but if m be negative, or $\frac{m}{n}$

a fraction, the series will consist of an indefinite number of terms. Examples of the application of the theorem have been already given upon the first supposition, when treating of involution; we now proceed to shew how it is to be applied to the expansion of algebraic quantities into series upon either of the two last hypotheses.

270. *Ex. 1.* It is required to express $\frac{r^3}{(r+x)^3}$ by means of a series.

$$\text{Because } \frac{r}{r+x} = \frac{1}{1+\frac{x}{r}},$$

$$\text{Therefore } \frac{r^3}{(r+x)^3} = \frac{1}{\left(1+\frac{x}{r}\right)^3} = \left(1+\frac{x}{a}\right)^{-3}$$

Let $\left(1+\frac{x}{r}\right)^{-3}$ be compared with $(a+x)^{\frac{m}{n}}$ and we have

$$a=1, x=\frac{x}{r}, m=-3, n=1.$$

Hence, by substituting these values of a, x, m, n in the first general formula of § 267, we have

$$\frac{r^3}{(r+x)^3} \begin{cases} = 1 - \frac{3x}{r} + \frac{3 \cdot 4x^2}{1 \cdot 2 r^2} - \frac{3 \cdot 4 \cdot 5x^3}{1 \cdot 2 \cdot 3 r^3} +, \text{ \&c.} \\ = 1 - \frac{3x}{r} + \frac{6x^2}{r^2} - \frac{10x^3}{r^3} + \frac{15x^4}{r^4} +, \text{ \&c.} \end{cases}$$

Ex. 2.

Reversion
of Series.

Reversion
of Series.

Ex. 2. It is required to express $\sqrt[3]{a+b}$ by the form of a series.

Because $a+b=a\left(1+\frac{b}{a}\right)$

Therefore $\sqrt[3]{a+b} = \sqrt[3]{a} \times \sqrt[3]{1+\frac{b}{a}} = a^{\frac{1}{3}}\left(1+\frac{b}{a}\right)^{\frac{1}{3}}$

By comparing $\left(1+\frac{b}{a}\right)^{\frac{1}{3}}$ with $(a+x)^{\frac{m}{n}}$ we have $a=1, x=\frac{b}{a}, m=1, n=3$,
and substitute as in last example

$$\sqrt[3]{a+b} \begin{cases} = a^{\frac{1}{3}} \left(1 + \frac{1.b}{3a} - \frac{1.2b^2}{3.6a^3} + \frac{1.2.5b^3}{3.6.9a^3} - \frac{1.2.5.8b^4}{3.6.9.12a^4} +, \&c. \right) \\ = a^{\frac{1}{3}} \left(1 + \frac{b}{3a} - \frac{b^2}{9a^2} + \frac{5b^3}{81a^3} - \frac{10b^4}{243a^4} +, \&c. \right) \end{cases}$$

Ex. 3. It is required to resolve $\frac{r^2}{(r^3+z^3)^{\frac{2}{3}}}$ into a series.

Because $\frac{r^2}{(r^3+z^3)^{\frac{2}{3}}} = r^2 \times (r^3+z^3)^{-\frac{2}{3}}$, if we raise r^3+z^3 to the $-\frac{2}{3}$ power, and multiply the resulting series by r^2 , we shall have the series required. Or the given quantity may be reduced to a more simple form, thus;
because $r^3+z^3=r^3\left(1+\frac{z^3}{r^3}\right)$

Therefore $(r^3+z^3)^{\frac{2}{3}} = r^2\left(1+\frac{z^3}{r^3}\right)^{\frac{2}{3}}$, and

$\frac{r^2}{(r^3+z^3)^{\frac{2}{3}}} = \frac{1}{\left(1+\frac{z^3}{r^3}\right)^{\frac{2}{3}}} = \left(1+\frac{z^3}{r^3}\right)^{-\frac{2}{3}}$. Hence

$$\frac{r^2}{(r^3+z^3)^{\frac{2}{3}}} \begin{cases} = \left(1+\frac{z^3}{r^3}\right)^{-\frac{2}{3}} \\ = 1 - \frac{2z^3}{3r^3} + \frac{2.5z^6}{3.6r^6} - \frac{2.5.8z^9}{3.6.9r^9} + \frac{2.5.8.11z^{12}}{3.6.9.12r^{12}} -, \&c. \\ = 1 - \frac{2z^3}{3r^3} + \frac{5z^6}{9} - \frac{40z^9}{81r^9} + \frac{110z^{12}}{243r^{12}} -, \&c. \end{cases}$$

Ex. 4. It is required to find a series equal to $\frac{\sqrt{a^2+x^2}}{\sqrt{a^2-x^2}}$.

First by the binomial theorem we have

$\sqrt{a^2+x^2} = (a^2+x^2)^{\frac{1}{2}} = a + \frac{x^2}{2a} - \frac{x^4}{8a^3} + \frac{x^6}{16a^5} -, \&c.$

$\frac{1}{\sqrt{a^2-x^2}} = (a^2-x^2)^{-\frac{1}{2}} = \frac{1}{a} + \frac{x^2}{2a^3} + \frac{3x^4}{8a^5} + \frac{5x^6}{16a^7} -, \&c.$

Therefore, by taking the product of the two series, and proceeding in the operation only to such terms as involve the 6th power of x , we find

$\frac{\sqrt{a^2+x^2}}{\sqrt{a^2-x^2}} = 1 + \frac{x^2}{a^2} - \frac{x^4}{2a^4} + \frac{x^6}{2a^6}, \&c.$

SECT. XVIII. Of the Reversion of Series.

271. THE method of indeterminate coefficients, which we have already employed when treating of infinite se-

ries, may also be applied to what is called the reverting of series; that is, having any quantity expressed by an infinite series composed of the powers of another quantity, to express, on the contrary, the latter quantity by means of an infinite series composed of the powers of the former.

272. Let $y=n+ax+bx^2+cx^3+dx^4+, \&c.$

Then to revert the series we must find the value of x in terms of y . For this purpose we shall transpose n , and put $z=y-n$, then

$z=ax+bx^2+cx^3+dx^4+, \&c.$

Now when $z=0$, it is evident that $x=0$, therefore we may assume for x a series of this form,

$x=Ax+Bx^2+Cx^3+Dx^4+, \&c.$

where the coefficients $A, B, C, D, \&c.$ denote quantities as yet unknown, but which are entirely independent of the quantity x . To determine those quantities let the first, second, third, $\&c.$ powers of the series,

$Ax+Bx^2+Cx^3+Dx^4+, \&c.$

Of Logarithms, &c. x^3 , &c. respectively, in the equation

$$0 = -x + ax + bx^2 + cx^3, \text{ \&c.}$$

thus we have

$$\left. \begin{aligned} -x &= -x \\ +ax &= aAx + aBx^2 + aCx^3 + aDx^4 + \text{\&c.} \\ +bx^2 &= bAx^2 + 2bABx^3 + 2bACx^4 + \text{\&c.} \\ +cx^3 &= cAx^3 + 3cA^2Bx^4 + \text{\&c.} \\ +dx^4 &= dAx^4 + \text{\&c.} \end{aligned} \right\} = 0$$

and, putting the coefficients of x , x^2 , x^3 , &c. each $= 0$,

$$aA - 1 = 0, \quad aB + bA^2 = 0, \quad aC + 2bAB + cA^3 = 0$$

$$aD + 2bAC + bB^2 + 3cA^2B + dA^4 = 0, \text{ \&c.}$$

these equations give

$$A = \frac{1}{a}$$

$$B = -\frac{b}{a^3}$$

$$C = \frac{2b^2 - ac}{a^5}$$

$$D = -\frac{5b^3 - 5abc + a^2d}{a^7}$$

&c.

$$\text{Therefore } x = \frac{1}{a}x - \frac{b}{a^3}x^2 + \frac{2b^2 - ac}{a^5}x^3 - \frac{5b^3 - 5abc + a^2d}{a^7}x^4 + \text{\&c.}$$

273. As an example of the application of this formula, let it be required to determine x from the equation

$$y = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \text{\&c.}$$

In this case we have

$$x = y, \quad a = 1, \quad b = -\frac{1}{2}, \quad c = \frac{1}{3}, \quad d = -\frac{1}{4}, \text{ \&c.}$$

Therefore, substituting these values, we have

$$x = y + \frac{y^2}{2} + \frac{y^3}{6} + \frac{y^4}{24} + \text{\&c.}$$

274. In the equation

$$ay + by^2 + cy^3 + \text{\&c.} = a'x + b'x^2 + c'x^3 + \text{\&c.}$$

in which both sides are expressed by series, and it is required to find y in terms of x , we must assume, as before,

$$y = Ax + Bx^2 + Cx^3 + Dx^4 + \text{\&c.}$$

and substitute this series and its powers for y and its powers in the proposed equation; afterwards, by bringing all the terms to one side, and making the coefficients of each power of y , $= 0$, a series of equations will be had by which the quantities A , B , C , D , &c. may be determined.

SECT. XIX. Of Logarithms and Exponential Quantities.

275. ALL positive numbers may be considered as powers of any one given affirmative number. The

powers of 2, for instance, may become equal, either exactly, or nearer than by any assignable difference, to all numbers whatever, from 0 upwards. If the exponents be integers, we shall have only the numbers which form the geometrical progression, 1, 2, 4, 8, 16, &c.: but the intermediate numbers may be expressed, at least nearly, by means of fractional exponents. Thus the numbers from 0 to 10 may be expressed by the powers of 2 as follows:

$$\begin{array}{ll} 2^0 = 1 & 2^{1.585} = 6 \\ 2^1 = 2 & 2^{2.807} = 7 \\ 2^{1.585} = 3 & 2^3 = 8 \\ 2^2 = 4 & 2^{3.170} = 9 \\ 2^{3.322} = 5 & 2^{3.322} = 10 \end{array}$$

In like manner may fractions be expressed by the powers of 2. Thus

$$.1 = \frac{1}{2^{3.322}} = 2^{-3.322}, \quad .2 = \frac{1}{2^{2.322}} = 2^{-2.322},$$

$$.3 = \frac{1}{2^{1.585}} = 2^{-1.585}, \text{ \&c.}$$

where it is observable that the exponents are now negative.

In the same manner may all numbers be expressed by the powers of 10. Thus,

$$\begin{array}{ll} 10^0 = 1 & 10^{-1} = .1 \\ 10^{.301} = 2 & 10^{-.699} = .2 \\ 10^{.477} = 3 & 10^{-.523} = .3 \\ \text{\&c.} & \text{\&c.} \end{array}$$

276. Even a fraction might be taken in place of 2, or 10, in the preceding examples; and such exponents might be found as would give its powers equal to all numbers, from 0 upwards. There are therefore no limitations with respect to the magnitude of the number, by the powers of which all other numbers are to be expressed, except that it must neither be equal to unity, nor negative. If it were $= 1$, then all its powers would also be $= 1$, and if it were negative, there are numbers to which none of its powers could possibly be equal.

277. If therefore y denote any number whatever, and r a given number, a number x may be found, such, that $r^x = y$, and x , that is, the exponent of r which gives a number equal to y , is called the *logarithm* of y .

278. The given number r , by the powers of which all other numbers are expressed, is called the *radical number* of the logarithms, which are the indices of those powers.

279. From the preceding definition of logarithms their properties are easily deduced, as follows:

1. The sum of two logarithms is equal to the logarithm of their product. Let y and y' be two numbers, and x and x' their logarithms, so that $r^x = y$, and $r^{x'} = y'$, then $r^x \times r^{x'} = yy'$, or $r^{x+x'} = yy'$; hence, from the definition, $x+x'$ is the logarithm of yy' , that is, the sum of the logarithms of y and y' is the logarithm of yy' .

2. The difference of the logarithms of two numbers is equal to the logarithm of their quotient; for if

Logarithms, &c. if $rx = y$ and $rx' = y'$, then $\frac{rx}{rx'} = \frac{y}{y'}$ or $rx - x' = \frac{y}{y'}$,

therefore, by the definition, $x - x'$ is the logarithm of $\frac{y}{y'}$; that is, the difference of the logarithms of y and y'

is the logarithm of $\frac{y}{y'}$.

3. Let n be any number whatever, then, $\log. N^n = n \times \log. N$. For N^n is N multiplied into itself n times, therefore the logarithm of N^n is equal the logarithm of N added to itself n times, or to $n \times \log. N$.

280. From these properties of logarithms it follows, that if we possess tables by which we can assign the logarithm corresponding to any given number, and also the number corresponding to any given logarithm, the operations of multiplication and division of numbers may be reduced to the addition and subtraction of their logarithms, and the operations of involution and evolution to the more simple operations of multiplication and division. Thus, if two numbers x and y are to be multiplied together, by taking the sum of their logarithms, we obtain the logarithm of their product, and, by inspecting the table, the product itself. A similar observation applies to the quotient of two numbers, and also to any power or to any root of a number.

281. The general properties of logarithms are independent of any particular value of the radical number, and hence there may be various systems of logarithms, according to the radical number employed in their construction. Thus if the radical number be 10, we shall have the common system of logarithms, but if it were 2.7182818 we should have the logarithms first constructed by Lord Napier, which are called *hyperbolic logarithms*.

282. We have already observed (§ 277.), that the relation between any number and its logarithm is expressed by the equation $rx = y$, where y denotes a number, x its logarithm, and r the radical number of the system, and any two of these three quantities being given, the remaining one may be found. If either y or r were the quantity required, the exponent would involve no difficulty; if, however, the exponent x were considered as the unknown quantity while r and y were supposed given, the equation to be resolved would be of a different form than any that we have hitherto considered. Equations of this form are called *exponential equations*. To resolve such an equation is evidently the same thing as to determine the logarithm of a given number, and this problem we shall now proceed to investigate.

283. We therefore resume the equation $rx = y$, where r , x , and y denote, as before, we are to find a value of x in terms of r and y . Let us suppose $r = 1 + a$ and $y = 1 + v$, then our equation will stand thus,

$$(1 + a)^x = 1 + v.$$

So that, by raising both sides to the power n , where n denotes an indefinite number, which is to disappear in the course of the investigation, we have $(1 + a)^{nx} = (1 + v)^n$, and resolving both sides of the equation into series by means of the binomial theorem,

$$\begin{aligned} 1 + na + \frac{nx(nx-1)}{1 \cdot 2} a^2 + \frac{nx(nx-1)(nx-2)}{1 \cdot 2 \cdot 3} a^3 \\ + \frac{nx(nx-1)(nx-2)(nx-3)}{1 \cdot 2 \cdot 3 \cdot 4} a^4 +, \&c. \\ = 1 + nv + \frac{n(n-1)}{1 \cdot 2} v^2 + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} v^3 \\ + \frac{n(n-1)(n-2)(n-3)}{1 \cdot 2 \cdot 3 \cdot 4} v^4 +, \&c. \end{aligned}$$

Therefore, subtracting unity from both sides, and dividing by n , we have

$$\begin{aligned} xa + \frac{x(nx-1)}{1 \cdot 2} a^2 + \frac{x(nx-1)(nx-2)}{1 \cdot 2 \cdot 3} a^3 \\ + \frac{x(nx-1)(nx-2)(nx-3)}{1 \cdot 2 \cdot 3 \cdot 4} a^4 +, \&c. \\ = v + \frac{n-1}{1 \cdot 2} v^2 + \frac{(n-1)(n-2)}{1 \cdot 2 \cdot 3} v^3 \\ + \frac{(n-1)(n-2)(n-3)}{1 \cdot 2 \cdot 3 \cdot 4} v^4 +, \&c. \end{aligned}$$

and by supposing the factors which constitute the terms of each series to be actually multiplied, and the products arranged according to the power of n , the last equation will have this form,

$$\begin{aligned} xa + \left(Pn - \frac{x}{2}\right)a^2 + \left(P'n + Qn^2 + \frac{x}{3}\right)a^3 + \left(P''n + Q'n^2 \right. \\ \left. + Rn^3 - \frac{x}{4}\right)a^4 +, \&c. \\ = v + \left(pn - \frac{1}{2}\right)v^2 + \left(p'n + qn^2 + \frac{1}{3}\right)v^3 + \left(p''n + q'n^2 + rn^3 \right. \\ \left. - \frac{1}{4}\right)v^4 +, \&c. \end{aligned}$$

Here the coefficients of the power n , viz. $P, P', P'', \&c. Q, Q', \&c. R, \&c.$ also $p, p', p'', \&c. q, q', \&c. r, \&c.$ are expressions which denote certain combinations of the powers of x in the first series, and certain numbers in the second; but as they are all to vanish in the course of the investigation, it is not necessary that they should be expressed in any other way than by a single letter.

284. Now each side of this last equation may evidently be resolved into two parts, one of which is entirely free from the quantity n , and the other involves that quantity, hence the same equation may also stand thus,

$$\begin{aligned} xa - \frac{x}{2}a^2 + \frac{x}{3}a^3 - \frac{x}{4}a^4 +, \&c. \\ + Pna^2 + (P'n + Qn^2)a^3 + (P''n + Q'n^2 + Rn^3)a^4 + \&c. \\ = \left\{ \begin{aligned} &v - \frac{1}{2}v^2 + \frac{1}{3}v^3 - \frac{1}{4}v^4 +, \&c. \\ &+ pnv^2 + (p'n + qn^2)v + (p''n + q'n^2 + rn^3)v^2 + \&c. \end{aligned} \right\} \end{aligned}$$

This equation must hold true, whatever be the value of n , which is a quantity entirely arbitrary, and therefore ought to vanish from the equation expressing the relation between x and v ; hence it follows that the terms on each side of the equation, which involve n , ought to destroy each other, and thus there will remain,

Of Logarithms, &c. n , that is,

$$x a - \frac{x a^2}{2} + \frac{x a^3}{3} - \frac{x a^4}{4} +, \&c. = v - \frac{v^2}{2} + \frac{v^3}{3} - \frac{v^4}{4} +, \&c.$$

$$\text{or } (a - \frac{a^2}{2} + \frac{a^3}{3} - \frac{a^4}{4} +, \&c. x = v - \frac{v^2}{2} + \frac{v^3}{3} - \frac{v^4}{4} + \frac{v^5}{5} -, \&c.$$

Let us now put A to denote the constant multiplier

$$a - \frac{a^2}{2} + \frac{a^3}{3} - \frac{a^4}{4} +, \&c. = (r-1) - \frac{(r-1)^2}{2} + \frac{(r-1)^3}{3} - \frac{(r-1)^4}{4} +, \&c.$$

and substitute for v , its value y , thus we at last find

$$x = \log. y = \frac{1}{A} (y-1) - \frac{(y-1)^2}{2} + \frac{(y-1)^3}{3} - \frac{(y-1)^4}{4} +, \&c.$$

and by this formula the logarithm of any number a little greater than unity may be readily found.

285. If y be nearly $= 2$, the series will, however, converge too slowly to be of use, and if it exceed 2, the series will diverge, and therefore cannot be directly applied to the finding of its logarithm. But a series which shall converge faster, and be applicable to every case, may be investigated as follows:

$$\log. \frac{n+z}{n} = \frac{1}{A} \left(\frac{2z}{2n+z} + \frac{1}{3} \frac{2z^3}{(2n+z)^3} + \frac{1}{5} \frac{2z^5}{(2n+z)^5} +, \&c. \right)$$

$$\text{But } \log. \frac{n+z}{n} = \log. (n+z) - \log. n, \text{ therefore}$$

$$\log. (n+z) = \log. n + \frac{1}{A} \left(\frac{2z}{2n+z} + \frac{1}{3} \frac{2z^3}{(2n+z)^3} + \frac{2z^5}{(2n+z)^5} +, \&c. \right)$$

This series gives the logarithm of $n+z$ by means of the logarithm of n , and converges very fast when n is considerable.

287. It appears from the series which have been found for $\log. y$ in § 284 and 285, that the logarithm of a number is always the product of two quantities; one of these is variable, and depends upon the number itself, but the other, viz. $\frac{1}{A}$ is constant, and depends entirely on the radical number of the system. This quantity has been called by writers on logarithms the *modulus* of the system.

288. The most simple system of logarithms, in respect to facility of computation, is that in which $\frac{1}{A} = 1$ or $A = 1$. The logarithms of this system are the same as those first invented by Napier, and are also called *hyperbolic logarithms*.

The hyperbolic logarithm of any numbers y , is therefore (§ 284),

$$y-1 - \frac{(y-1)^2}{2} + \frac{(y-1)^3}{3} -, \&c.$$

and that of r , the radical number of any system, is

$$\text{Because } \log. (1+v) = \frac{1}{A} \left(v - \frac{v^2}{2} + \frac{v^3}{3} - \frac{v^4}{4} +, \&c. \right) \quad \text{Of Logarithms, \&c.}$$

By substituting $-v$ for $+v$, we have

$$\log. (1-v) = \frac{1}{A} \left(-v - \frac{v^2}{2} - \frac{v^3}{3} - \frac{v^4}{4} -, \&c. \right)$$

$$\text{Now, } \log. (1+v) - \log. (1-v) = \log. \frac{1+v}{1-v},$$

therefore, subtracting the latter series from the former,

$$\text{we have } \log. \frac{1+v}{1-v} = \frac{1}{A} \left(2v + \frac{2v^3}{3} + \frac{2v^5}{5} + \frac{2v^7}{7} +, \&c. \right)$$

Put $\frac{1+v}{1-v} = y$, then $v = \frac{y-1}{y+1}$, and the last series becomes

$$\log. y = \frac{1}{A} \left(2 \left(\frac{y-1}{y+1} \right) + \frac{2}{3} \left(\frac{y-1}{y+1} \right)^3 + \frac{2}{5} \left(\frac{y-1}{y+1} \right)^5 +, \&c. \right)$$

This series will always converge whatever be the value of y , and by means of it the logarithms of small numbers may be found with great facility.

286. When a number is composite, its logarithm will most easily be found, by adding together the logarithms of its factors; but if it be a prime number, its logarithm may be derived from that of some convenient composite number, either greater or less, and an infinite series. Let n be a number of which the logarithm is already found; then substituting $\frac{n+z}{n}$ for y in the last formula, we have

$$r-1 - \frac{(r-1)^2}{2} + \frac{(r-1)^3}{3} -, \&c.$$

but this last series is the same as we have denoted by A ; hence it follows, that the *modulus* of any system is the reciprocal of the hyperbolic logarithm of the radical number of that system. Thus it appears, that the logarithms of numbers, according to any proposed system, may be readily found from the hyperbolic logarithm of the same numbers, and the hyperbolic logarithm of the radical number of that system.

289. Let L denote the hyp. log. of any number, and l, l' the logarithms of the same number according to two other systems whose *moduli* are m and m' ; then

$$l = m L, \quad l' = m' L;$$

$$\text{therefore } \frac{l}{m} = \frac{l'}{m'}, \text{ and } m : m' :: l : l'.$$

That is, the logarithms of the same number, according to different systems, are directly proportional to the *moduli* of those systems, and therefore have a given ratio to one another.

290. We shall now apply the series here investigated to the calculation of the hyperbolic logarithm of 10, the reciprocal of which is the *modulus* of the common system

Loga- system of logarithms; and also to the calculation of
hms, &c. the common logarithm of 2. The hyp. log. of 10
may be obtained by substituting 10 for y in the formula

$$\text{hyp. log. } y = \frac{2(y-1)}{y+1} + \frac{2}{3} \frac{(y-1)^3}{y+1} + \frac{2}{5} \frac{(y-1)^5}{y+1} + \&c.$$

but the resulting series $\frac{2 \cdot 9}{11} + \frac{2 \cdot 9^3}{3 \cdot 11^3} + \frac{2 \cdot 9^5}{5 \cdot 11^5} + \&c.$ con-

verges too slowly to be of any practical utility, it will therefore be better to derive the logarithm of 10 from those of 2 and 5. By substituting 2 in the formula we have

$$\text{hyp. log. } 2 = 2 \left(\frac{1}{3} + \frac{1}{3 \cdot 3^3} + \frac{1}{5 \cdot 3^5} + \frac{1}{7 \cdot 3^7} + \&c. \right)$$

This series converges very fast, so that by reducing its terms to decimal fractions, and taking the sum of the first seven terms, we find the hyp. log. of 2 to be .6931472.

The hyp. log. of 5 may be found in the same manner, but more easily from the formula given in § 286. For the log. of 2 being given, that of $4=2^2$ is also given, § 279. Therefore, substituting $\log. 4=2 \log. 2$ for $\log. n$, and 1 for x , in the series

$$\text{hyp. log. } (n+x) = \text{hyp. log. } n + 2 \left(\frac{x}{2n+x} + \frac{1}{3} \frac{x^3}{(2n+x)^3} + \frac{1}{5} \frac{x^5}{(2n+x)^5} + \&c. \right)$$

we have

$$\text{hyp. log. } 5 = 2 \text{ hyp. log. } 2 + 2 \left(\frac{1}{9} + \frac{1}{3 \cdot 9^3} + \frac{1}{5 \cdot 9^5} + \&c. \right)$$

The first three terms of this series are sufficient to give the result true to the seventh decimal, so that we have hyp. log. 5 = 1.6094379, and

$$\text{hyp. log. } 10 = \text{hyp. log. } 2 + \text{hyp. log. } 5 = 2.3025851.$$

Hence the modulus of the common system of logarithms, or $\frac{1}{\text{hyp. log. } 10}$, is found = .4342945. The same number, because of its great utility in the construction of tables of logarithms, has been calculated to a much greater number of decimals. A celebrated calculator of the last century, Mr A. Sharp, found it to be

$$0.434294481903251827651128918916605082294397005803666566114454.$$

Having found the hyp. log. of 2 to be .6931472, the common logarithm of 2 is had immediately, by multiplying the hyp. log. of 2 by the modulus of the system; thus we find

$$\text{com. log. } 2 = 4.342945 \times .6931472 = .3010300.$$

291. We have already observed, § 282, that to determine the logarithm of a given number, is the same problem as to determine the value of x in an equation of this form, $a^x = b$, where the unknown quantity is an exponent. But in order to resolve such an equation, it is not necessary to have recourse to series; for a table of logarithms being once supposed constructed, the value of x may be determined thus. It appears, from § 279, that $x \times \log. a = \log. b$. Hence it follows,

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that $x = \frac{\log. b}{\log. a}$. The use of this formula will appear in next section, which treats of computations relative to annuities.

292. The theory of logarithms requires the solution of this other problem. Having given the radical number of a system, and a logarithm, to determine the corresponding number. Or having given the equation $r^x = y$, where r , x , and y denote, as in § 282, to find a series which shall express y in terms of r and x .

293. For this purpose, let us suppose $r = 1 + a$, then our equation becomes $y = (1 + a)^x$, which may also be expressed thus:

$$y = [(1 + a)^n]^{\frac{x}{n}},$$

where n is an indefinite quantity, which is to disappear in the course of the investigation.

By the binomial theorem we have

$$(1 + a)^n = 1 + na + \frac{n(n-1)}{1 \cdot 2} a^2 + \frac{n(n-1)(n-2)}{1 \cdot 2 \cdot 3} a^3 + \&c.$$

This equation, by multiplying together the factors which compose the terms of the series, and arranging the results according to the powers of n , may also be expressed thus:

$$(1 + a)^n = 1 + An + Bn^2 + Cn^3 + \&c.$$

where it will readily appear that

$$A = a - \frac{a^2}{1} + \frac{a^3}{3} - \frac{a^4}{4} + \&c.$$

As to the values of B , C , &c. it is of no importance to know them, for they will all disappear in the course of the investigation. Hence, by substituting for $(1 + a)^n$ its value, as expressed by this last series, we have

$$y = (1 + An + Bn^2 + Cn^3 + \&c.)^{\frac{x}{n}}$$

and expanding the latter part of this equation by means of the binomial theorem, it becomes

$$y = 1 + \frac{x}{n} (An + Bn^2 + \&c.) + \frac{x(x-n)}{1 \cdot 2 \cdot n^2} (An + Bn^2 + \&c.)^2 + \frac{x(x-n)(x-2n)}{1 \cdot 2 \cdot 3 \cdot n^3} (An + Bn^2 + \&c.)^3 + \&c.$$

But $An + Bn^2 + \&c. = n(A + Bn + \&c.)$ also $(An + Bn^2 + \&c.)^2 = n^2(A + Bn + \&c.)^2$, and $(An + Bn^2 + \&c.)^3 = n^3(A + Bn + \&c.)^3$, &c.

therefore, by leaving out of each term of the series the powers of n , which are common to the numerator and denominator, the equation will stand thus:

$$y = 1 + x(A + Bn + \&c.) + \frac{x(x-n)}{1 \cdot 2} (A + Bn + \&c.)^2 + \frac{x(x-n)(x-2n)}{1 \cdot 2 \cdot 3} (A + Bn + \&c.)^3 + \&c.$$

Now n is here an arbitrary quantity, and ought, from the nature of the original equation, to disappear from the value of y ; the terms of the equation which are multiplied

Interest and multiplied by n ought therefore to destroy each other; Compound Interest
 Annuities. and this being the case, the equation is reduced to

$$r^x = y = 1 + \frac{x\Lambda}{1} + \frac{x^2\Lambda^2}{1 \cdot 2} + \frac{x^3\Lambda^3}{1 \cdot 2 \cdot 3} + \frac{x^4\Lambda^4}{1 \cdot 2 \cdot 3 \cdot 4} + \&c.$$

and since we have found

$$\Lambda = a - \frac{a^2}{2} + \frac{a^3}{3} - \frac{a^4}{4} + \&c.$$

$$= (r-1) - \frac{(r-1)^2}{2} + \frac{(r-1)^3}{3} - \frac{(r-1)^4}{4}.$$

It is evident from § 288, that Λ is the hyperbolic logarithm of the radical number of the system.

294. If, in the equation $r^x = y$, we suppose $x=1$, the value of y becomes

$$r = 1 + \frac{\Lambda}{1} + \frac{\Lambda^2}{1 \cdot 2} + \frac{\Lambda^3}{1 \cdot 2 \cdot 3} + \&c.$$

Here the radical number is expressed by means of its hyperbolic logarithm. Again, if we suppose $x = \frac{1}{\Lambda}$, then

$$r^{\frac{1}{\Lambda}} = 1 + \frac{1}{1} + \frac{1}{1 \cdot 2} + \frac{1}{1 \cdot 2 \cdot 3} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 4} + \&c.$$

Thus it appears that the quantity $r^{\frac{1}{\Lambda}}$ is equal to a constant number, which, by taking the sum of a sufficient number of terms of the series, will be found = 2.718281828459045... Let us denote this number

by e , then $r^{\frac{1}{\Lambda}} = e$, and hence $r = e^{\Lambda}$. Now, if we remark that Λ is the hyp. log. of r , it must be evident (§ 277. and 278.), that e is the radical number of the hyperbolic system of logarithms.

Again, since $r^{\frac{1}{\Lambda}} = e$, therefore $\frac{1}{\Lambda} \times \log. r = \log. e$ and $\Lambda = \frac{\log. r}{\log. e}$, here $\log. r$ and $\log. e$ denote logarithms taken according to any system whatever.

295. If we now resume the equation

$$r^x = y = 1 + \frac{x\Lambda}{1} + \frac{x^2\Lambda^2}{1 \cdot 2} + \frac{x^3\Lambda^3}{1 \cdot 2 \cdot 3} + \&c.$$

and substitute for Λ its value $\frac{\log. r}{\log. e}$, we shall have the following general expression for any exponential quantity whatever,

$$r^x = 1 + \frac{x(\log. r)}{1(\log. e)} + \frac{x^2(\log. r)^2}{1 \cdot 2(\log. e)^2} + \frac{x^3(\log. r)^3}{1 \cdot 2 \cdot 3(\log. e)^3} + \&c.$$

which, by supposing $r=e$, becomes

$$e^x = 1 + \frac{x}{1} + \frac{x^2}{1 \cdot 2} + \frac{x^3}{1 \cdot 2 \cdot 3} + \&c.$$

SECT. XX. Of Interest and Annuities.

296. THE theory of logarithms finds its application in some measure to calculations relating to interest and annuities: these we now proceed to explain. There

are two hypotheses according to either of which money put out at interest may be supposed to be improved. We may suppose that the interest, which is always proportional to the sum lent, or principal, is also proportional to the time during which the principal is employed; and on this hypothesis the money is said to be improved at *simple* interest. Or we may suppose that the interest which ought to be paid to the lender at successive stated periods, is added to the principal instead of being actually paid, and thus their amount converted into a new principal. When money is laid out according to this second hypothesis, it is said to be improved at *compound* interest.

297. In calculations relating to interest, the things to be considered are the *principal*, or sum lent; the *rate of interest*, or sum paid for the use of 100l. for one year; the *time* during which the principal is lent; and the *amount*, or sum of the principal and interest, at the end of that time.

Let p denote the principal, 1l. being the unit.

r the interest of 1l. for one year, at the given rate.

t the time, one year being the unit.

a the amount.

We shall now examine the relations which subsist between these quantities, according to each of the two hypotheses of simple and compound interest.

I. Simple Interest.

298. Because the interest of 1l. for one year is r , the interest of 1l. for t years must be rt , and the interest of p pounds for the same time prt , hence we have this formula

$$p + prt = a,$$

from which we find

$$p = \frac{a}{1 + rt} \quad r = \frac{a - p}{pt} \quad t = \frac{a - p}{pr}.$$

As the manner of applying these formulæ to questions relating to simple interest is sufficiently obvious, we proceed to consider compound interest.

II. Compound Interest.

299. In addition to the symbols already assumed, let $R = 1 + r$ = amount of 1l. in one year; then, from the nature of compound interest, R is also the principal at the beginning of the second year. Now, interest being always proportional to the principal, we have

$$1 : r :: R : rR = \text{the interest of } R \text{ for a year,}$$

and $R + rR = (1 + r)R = R^2$ = amount of R in a year,

therefore R^2 is the amount of 1l. in two years, which sum being assumed as a new principal, we find, as before, its interest for a year to be rR^2 , and its amount $R^2 + rR^2 = (1 + r)R^2 = R^3$; so that R^3 is the amount of 1l. in three years. Proceeding in this manner, we find, in general, that the amount of 1l. in t years is R^t , and of p pounds pR^t ; hence we have this formula

$$pR^t = a,$$

which

annuities, which from the nature of logarithms may also be expressed thus :

$$\log. p + t \times \log. R = \log. a.$$

Hence we find

$$p = \frac{a}{R^t} \quad R = t \sqrt[t]{\frac{a}{p}};$$

or, by logarithms,

$$\log. p = \log. a - t \times \log. R. \quad \log. R = \frac{\log. a - \log. p}{t}$$

$$t = \frac{\log. a - \log. p}{\log. R}.$$

300. As an example of the use of these formulæ, let it be required to determine what sum improved at 5 per cent. compound interest will amount to 500l. in 42 years. In this case we have given $a=500$ $r=.05$, $R=1.05$, $t=42$, to find p .

From	$\log. a = \log. 500 =$	2 6989700
subtract	$t \times \log. R = 42 \times \log. 1.05 =$	0.8899506

remains $\log. p$	1.8090194
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therefore $p = 64.421 = 641. 8s. 5d.$ the sum required.

Ex. 2. In what time will a sum laid out at 4 per cent. compound interest be doubled ?

Let any sum be expressed by unity, then we have given $p=1$, $r=.04$, $R=1.04$, $a=2$, to find t .

$$\text{From the formula } t = \frac{\log. a - \log. p}{\log. R} = \frac{\log. 2}{\log. 1.04}$$

$$\text{we find } t = \frac{.3010300}{.0170333} = 17.7 \text{ years nearly.}$$

301. In treating of compound interest, we have supposed the interest to be joined to the principal at the end of the year. But we might have supposed it to be added at the end of every half year or every quarter, or even every instant; and suitable rules might have been found for performing calculations according to each hypothesis. As such suppositions are, however, never made in actual business, we shall not at present say any thing more of them.

III. Annuities.

302. An annuity is a payment made annually for a term of terms; and the chief problem relating to it is to determine its present worth, that is, the sum a person ought to pay immediately to another, upon condition of receiving from the latter a certain sum annually for a given time. In resolving this problem, it is supposed that the buyer improves his annuity from the time he receives it, and the seller the purchase money, in a certain manner, during the continuance of the annuity, so that at the end of the time the amount of each may be the same. There may be various suppositions as to the way in which the annuity and its purchase money may be improved; but the only one commonly applied to practice is the highest improvement possible of both, viz. by compound interest. As the taking compound interest is, however, prohibited by law, the realizing of this supposed improvement re-

quires punctual payment of interest; and therefore the interest in such calculations is usually made low.

Continued
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303. Let A denote the annuity;
 P the present worth, or purchase money;
 t the time of its continuance;

let r and R denote as before.

The seller, by improving the price P at compound interest during the time t , has PR^t .

The purchaser is supposed to receive the first annuity A at the end of one year, which, being improved for $t-1$ years, amounts to AR^{t-1} . He receives the second year's annuity at the end of the second year, which, being improved for $t-2$ years, amounts to AR^{t-2} . In like manner the third year's annuity becomes AR^{t-3} , and so on to the last year's annuity, which is simply A . Therefore, the whole amount of the improved annuities is the geometrical series

$$A + AR + AR^2 + AR^3 \dots + AR^{t-1},$$

the sum of which, by § 106, is $A \frac{R^t - 1}{R - 1} = A \frac{R^t - 1}{r}$;

and since this sum must be equal to the amount of the purchase money, or PR^t , we have

$$PR^t = A \frac{R^t - 1}{r};$$

and from this equation, we find

$$P = \frac{A}{r} \left(1 - \frac{1}{R^t} \right). \quad A = \frac{r PR^t}{R - 1}. \quad t = \frac{\log. A - \log. (A - rP)}{\log. R}.$$

As to r , it can only be found by the resolution of an equation of the t order.

304. To find the present value of an annuity in *reversion*, that is, an annuity which is to commence at the end of n years, and continue during t years; first find its value for $n+t$ years, and then for n years; and subtract the latter from the former, we thus obtain the following formula :

$$P = \frac{A}{rR^n} \left(1 - \frac{1}{R^t} \right).$$

305. If the annuity is to commence immediately, and to continue for ever, then, because in this case R^t is

infinitely great, and therefore $\frac{1}{R^t} = 0$, the formula

$$P = \frac{A}{r} \left(1 + \frac{1}{R^t} \right) \text{ becomes simply } P = \frac{A}{r}.$$

And if the annuity is to commence after n years, and continue for ever, the formula $P = \frac{A}{rR^n} \left(1 - \frac{1}{R^t} \right)$ be-

$$\text{comes } P = \frac{A}{rR^n}.$$

SECT. XXI. Of Continued Fractions.

306. EVERY quantity which admits of being expressed by a common fraction may also be expressed in the

Continued the same order, it follows that their amount is also $=x$,
Fractions. thus we have

$$x = \frac{1}{2} + \frac{1}{3+x}$$

Hence $x = \frac{3+x}{6+2x+1}$ and $x^2+3x = \frac{3}{2}$ and $x = \frac{-3+\sqrt{15}}{2}$

Therefore $x+1$, or the sum of the series, $= \frac{-1+\sqrt{15}}{2}$

In general if $x = \frac{1}{a} + \frac{1}{b + \frac{1}{a+x}}$, &c.

we find $x = -\frac{b}{2} \pm \sqrt{\frac{b^2}{4} + a}$. Though the denominators did not return in the same order till after a greater interval, the value of the fraction would still be expressed by the root of a quadratic equation. And conversely, the roots of all quadratic equations may be expressed by periodical continued fractions, and may often by that means be very readily approximated in numbers, without the trouble of extracting the square root.

310. The reduction of a decimal into the form of a continued fraction sometimes renders the law of its continuation evident. Thus we know that $\sqrt{2} = 1.41421356 \dots$ but from the bare inspection of this decimal we discover no rule for its further continuation. If, however, it be reduced into a continued fraction, it becomes

$$= 1 + \frac{1}{2 + \frac{1}{2 + \frac{1}{2 + \dots}}}$$

and hence we see in what way it may be continued to any degree of accuracy.

311. When the root of any equation is found by the method explained in § 256, the value of the unknown quantity is evidently expressed by a continued fraction.

For if x be the root sought, we have $x = a + \frac{1}{y}$, $y = b$

$$+ \frac{1}{y'}, y' = b' + \frac{1}{y''}, y'' = b'' + \frac{1}{y'''}, \&c. \text{ where } a, b, b', b'', \&c. \text{ denote the whole numbers, which are next less than the true values of } x, y, y', y'', \&c. \text{ If there-}$$

fore in the value of x we substitute $b + \frac{1}{y'}$ for y , it becomes

$$x = a + \frac{1}{b + \frac{1}{y'}}$$

Again, if in this second value of x we substitute $b' + \frac{1}{y''}$ for y' , it becomes

$$x = a + \frac{1}{b + \frac{1}{b' + \frac{1}{y''}}}$$

The next value of x is in like manner found to be

$$x = a + \frac{1}{b + \frac{1}{b' + \frac{1}{b'' + \frac{1}{y'''}}}}$$

and so on continually.

SECT. XXII. Of Indeterminate Problems.

312. WHEN the conditions of a question are such that the number of equations exceeds the number of unknown quantities, that question will admit of innumerable solutions, and is therefore said to be indeterminate. Thus, if it be required to find two numbers subject to no other limitation than that their sum be 10, we have two unknown quantities x and y , and only one equation, viz. $x+y=10$, which may evidently be satisfied by innumerable different values of x and y , if fractional solutions be admitted. It is, however, usual in such questions as this, to restrict values of the numbers sought to positive integers, and therefore, in this case, we can have only these nine solutions;

$$\begin{aligned} x &= 1, 2, 3, 4, 5, 6, 7, 8, 9, \\ y &= 9, 8, 7, 6, 5, 4, 3, 2, 1, \end{aligned}$$

which indeed may be reduced to five, for the first four become the same as the last four, by simply changing x into y , and the contrary.

313. Indeterminate problems are of different orders according to the dimensions of the equation which is obtained after all the unknown quantities, but two, have been exterminated by means of the given equations. Those of the first order lead always to equations of this form,

$$ax + by = c,$$

where a, b, c denote given whole numbers, and x, y two numbers to be found, so that both may be integers. That this condition may be fulfilled, it is necessary that the coefficients a, b have no common divisor which is not also a divisor of c , for if $a = md$ and $b = me$, then $ax + by = mdx + mey = c$, and $dx + ey = \frac{c}{m}$; but d, e, x, y are supposed to be whole numbers, therefore $\frac{c}{m}$ is a whole number, hence m must be a divisor of c .

314. We proceed to illustrate the manner of resolving indeterminate equations of the first order by some numerical examples.

Ex. 1. Given $2x + 3y = 25$, to determine x and y in whole positive numbers.

From the given equation we have $x = \frac{25-3y}{2} = 12 - y + \frac{1-y}{2}$; now since a must be a whole number, it

follows that $\frac{1-y}{2}$ must be a whole number. Let us

assume $\frac{1-y}{2} = z$, then $1-y = 2z$ and $y = 1-2z$, and

since $x = 12 - y + \frac{1-y}{2} = 12 - y + z$, therefore $x =$

$12 - 1 + 2z + z$; hence we have

$$x = 11 + 3z, \quad y = 1 - 2z,$$

where

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where z might be any whole number whatever, if there were no limitation as to the signs of x and y ; but since these quantities are required to be positive, it is evident from the value of y , that z must either be 0 or negative, and from the value of x , that, abstracting from the sign, it must be less than 4; hence z may have these three values 0, -1, -2, -3.

$$\text{If } z=0, \quad z=-1, \quad z=-2, \quad z=-3. \\ \text{Then } \begin{cases} x=11, & x=8, & x=5, & x=2. \\ y=1, & y=3, & y=5, & y=7. \end{cases}$$

Ex. 2. It is required to divide 100 into such parts that the one may be divisible by 7 and the other by 11.

Let $7x$ be the first part, and $11y$ the second, then by the question $7x+11y=100$, and

$$x = \frac{100-11y}{7} = 14-y + \frac{2-4y}{7};$$

hence it appears, that $\frac{2-4y}{7}$ must be a whole number.

Let us assume $\frac{2-4y}{7}=z$, then $x=14-y+z$ and

$$4y=2-7z, \text{ or } y = \frac{2-7z}{4} = \frac{2-3z}{4} - z, \text{ therefore } \frac{2-3z}{4}$$

must be a whole number. Assume $\frac{2-3z}{4}=t$, then $y=$

$$t-z, \text{ and } 3z=2-4t, \text{ or } z = \frac{2-4t}{3} = \frac{2-t}{3} - t, \text{ there-}$$

fore $\frac{2-t}{3}$ must be a whole number.

$$\text{Assume now } \frac{2-t}{3}=v, \text{ then } z=v-t \text{ and } t=2-3v,$$

here it is evident v may be any whole number taken at pleasure, so that to determine x and y we have the following series of equations:

$$\begin{aligned} t &= 2-3v \\ z &= v-t = 4v-2 \\ y &= t-z = 4-7v \\ x &= 14-y+z = 11v+8. \end{aligned}$$

Now from the value of y it appears, that v must either be = 0, or negative; but from the value of x we find that v cannot be a negative whole number, therefore v can only be = 0; hence the only values which x and y can have in whole numbers, are $x=8$, $y=4$.

Ex. 3. It is required to find all the possible ways in which 60l. can be paid in guineas and moidores only.

Let x be the number of guineas and y the number of moidores. Then the value of the guineas, expressed in shillings, is $21x$, and that of the moidores $27y$, therefore, from the nature of the question, $21x+27y=1200$, or, dividing the equation by 3, $7x+9y=400$,

$$\text{hence } x = \frac{400-9y}{7} = 57-y + \frac{1-2y}{7}, \text{ so that } \frac{1-2y}{7}$$

must be a whole number.

$$\text{Assume } \frac{1-2y}{7}=z, \text{ then } x=57-y+z, \text{ and } 2y=1$$

$$-7z \text{ or } y = \frac{1-7z}{2} = \frac{1-z}{2} - 3z, \text{ therefore } \frac{1-z}{2} \text{ must be a whole number.}$$

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$$\text{Assume } \frac{1-z}{2}=v, \text{ then } y=v-3z, \text{ and } z=1-2v;$$

therefore v may be taken any whole number at pleasure, and x and y may be determined by the following equations:

$$\begin{aligned} z &= 1-2v \\ y &= v-3z = 7v-3 \\ x &= 57-y+z = 61-9v. \end{aligned}$$

From the value of x , it appears that v cannot exceed 6, and from the value of y , that it cannot be less than 1.

$$\begin{aligned} \text{Hence if } v &= 1, 2, 3, 4, 5, 6, \\ \text{we have } x &= 52, 43, 34, 25, 16, 7, \\ y &= 4, 11, 18, 25, 32, 39. \end{aligned}$$

315. In the foregoing examples the unknown quantities x and y have each a determinate number of positive values, and this will evidently be the case as often as the proposed equation is of this form, $ax+by=c$. If, however, b be negative, that is, if the equation be of this form $ax-by=c$, or $ax=by+c$, we shall have questions of a different kind, admitting each of an infinite number of solutions; these, however, are to be resolved in the same manner as the preceding, as will appear from the following example.

Ex. 4. A person buys some horses and oxen, he pays 31 crowns for each horse, and 20 crowns for each ox, and he finds that the oxen cost him seven crowns more than the horses. How many did he buy of each?

Let x be the number of horses, and y that of the oxen; then, by the question,

$$20x=31y+7, \text{ and } x = \frac{31y+7}{20} = y + \frac{11y+7}{20}.$$

$$\text{Therefore } \frac{11y+7}{20} \text{ must be a whole number.}$$

$$\text{Let } \frac{11y+7}{20}=v, \text{ then } x=y+v, \text{ and } y = \frac{20v-7}{11}=v$$

$$+ \frac{9v-7}{11}; \text{ hence } \frac{9v-7}{11} \text{ must be a whole number.}$$

$$\text{Let } \frac{9v-7}{11}=t, \text{ then } y=v+t \text{ and } v = \frac{11t+7}{9}=t+$$

$$\frac{2t+7}{9}; \text{ therefore } \frac{2t+7}{9} \text{ is a whole number.}$$

$$\text{Let } \frac{2t+7}{9}=s, \text{ then } v=t+s \text{ and } t = \frac{9s-7}{2}=4s+$$

$$\frac{s-7}{2}; \text{ therefore } \frac{s-7}{2} \text{ is a whole number.}$$

$$\text{Put } \frac{s-7}{2}=r, \text{ then } t=4s+r \text{ and } s=2r+7.$$

Having now no longer any fractions, we return to the values of x and y by the following series of equations,

$s=$

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nate Pro-
blems.

$$\begin{aligned} s &= 2r + 7 \\ t &= 4s + r = 9r + 28 \\ v &= t + s = 11r + 35 \\ y &= v + t = 20r + 63 = \text{number of oxen,} \\ x &= y + v = 31r + 98 = \text{number of horses.} \end{aligned}$$

The least positive values of x and y will evidently be obtained by making $r = -3$, and innumerable other values will be had by putting $r = -2$, $r = -1$, $r = 0$, $r = +1$, &c. Thus we have

$$\begin{aligned} x &= 5, 36, 67, 98, 129, 160, 191, 222, \&c. \\ y &= 3, 23, 43, 63, 83, 103, 123, 143, \&c. \end{aligned}$$

each series forming an arithmetical progression, the common difference in the first being 31, and in the second 20.

316. If we consider the manner in which the numbers x , y , in this example, are determined, from the succeeding quantities v , t , &c. we shall immediately perceive that the coefficients of those quantities are the same as the successive quotients which arise in the arithmetical operation for finding the greatest common measure of 20 and 31, the coefficients of the given equation $20x = 31y + 7$. The operation performed at length will stand thus :

$$\begin{array}{r} 20 \overline{) 31(1} \\ \underline{20} \\ 11 \overline{) 20(1} \\ \underline{11} \\ 9 \overline{) 11(1} \\ \underline{9} \\ 2 \overline{) 9(4} \\ \underline{8} \\ 1 \overline{) 2(2} \\ \underline{2} \\ 0 \end{array}$$

Hence we may form a series of numeral equations which, when compared with the series of literal equations expressing the relations between x , y , v , &c. as put down in the following table, will render the method of determining the latter from the former sufficiently obvious.

$$\begin{array}{ll} 31 = 1 \times 20 + 11 & x = 1 \times y + v \\ 20 = 1 \times 11 + 9 & y = 1 \times v + t \\ 11 = 1 \times 9 + 2 & v = 1 \times t + s \\ 9 = 4 \times 2 + 1 & t = 4 \times s + r \\ 2 = 2 \times 2 + 0 & s = 2 \times r + 7 \end{array}$$

And as every question of this kind may be analyzed in the same manner, we may hence form the following general rule for resolving indeterminate problems of the first order.

317. Let $bx = ay + n$ be the proposed equation, in which a , b , n are given integers, and x , y numbers to be found. Let a be the greatest of the two numbers a , b , and let A denote the greatest multiple of b which is contained in a , and c the remainder ; also let B denote

the greatest multiple of c contained in b , and d the remainder ; and C the greatest multiple of d contained in c , and e the remainder ; and so on, till one of the remainders be found equal to 0. The numbers A , B , C afford a series of equations from which another series may be derived, as in the following table :

$$\begin{array}{ll} a = Ab + c, & \text{hence we derive } x = Ay + v \\ b = Bc + d & y = Bv + t \\ c = Cd + e & v = Ct + s \\ d = De + f & t = Ds + r \\ e = Ef + g & s = Er + q \\ f = Fg + 0 & r = Fq \pm n \end{array}$$

and in the last equation of the second series any number whatever may be put for q : it is also to be observed, that the given number n is to have the sign + prefixed to it, if the number of equations be odd, but - if that number be even. Having formed the second series of equations, the values of x and y may be thence found as in the foregoing examples. We proceed to shew the application of the rule.

Ex. 5. Required a number which being divided by 11 leaves the remainder 3, but being divided by 19 leaves the remainder 5.

Let N be the number, and x , y the quotients which arise from the respective divisions, then we have $N = 11x + 3$, also $N = 19y + 5$; hence $11x + 3 = 19y + 5$, and $11x = 19y + 2$, an equation which furnishes the following table :

$$\begin{array}{ll} 19 = 1 \times 11 + 8 & x = y + v \\ 11 = 1 \times 8 + 3 & y = v + t \\ 8 = 2 \times 3 + 2 & v = 2t + s \\ 3 = 1 \times 2 + 1 & t = s + r \\ 2 = 2 \times 1 + 0 & s = 2r + 2 \end{array}$$

Here r may be assumed of any value whatever.

Hence we have

$$\begin{aligned} s &= 2r + 2 \\ t &= s + r = 3r + 2 \\ v &= 2t + s = 8r + 6 \\ y &= v + t = 11r + 8 \\ x &= y + v = 19r + 14 \end{aligned}$$

and the number required $N = 209r + 157$, where it is evident that the least number which can express N is 157.

Ex. 6. $\left\{ \begin{array}{l} 3x + y + 7z = 560 \\ 9x + 25y + 49z = 2920 \end{array} \right\}$ To determine x , y , z Given in whole numbers.

From 7 times the first equation subtract the second ; thus we have $12x + 10y = 1000$, or $6x + 5y = 500$; and from this last equation, by proceeding as in the foregoing example, we find

$$x = 500 - 5y, \quad y = 6v - 500.$$

Let these values of x and y be substituted in either of the original equations ; in the first, for example, as being the most simple, and we find $7x + 15v = 1560$. This last equation being resolved in the same manner, we find

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nate Pro-
blems.

$$\begin{aligned}v &= 1560 - 7t \\z &= 15t - 3120 \\y &= 8860 - 42t \\x &= 35t - 7300\end{aligned}$$

and hence it appears that the only values which t can have so as to give whole positive numbers for x , y , z are 209 and 210: thus we have

$$\begin{array}{lll}x=15 & y=82 & z=15 \\ \text{or } x=50 & y=40 & z=30.\end{array}$$

318. If an equation was proposed involving three unknown quantities, as $ax+by+cz=d$, by transposition we have $ax+by=d-cz$, and, putting $d-cz=d$, $ax+by=c'$. From this last equation we may find values of x and y of this form,

$$\begin{aligned}x &= mr + nc', \quad y = m'r + n'c', \\ \text{or } x &= mr + n(d-cz), \quad y = m'r + n'(d-cz),\end{aligned}$$

where z and r may be taken at pleasure, except in so far as the values of x , y , z , may be required to be all positive, for from such restriction the values of z and r may be confined within certain limits to be determined from the given equation.

319. We proceed to indeterminate problems of the second degree. These produce equations of the three following forms,

$$\text{I. } y = \frac{a}{b+cx}, \quad \text{II. } y = \frac{a+bx}{c+dx}, \quad \text{III. } y = \sqrt{a+bx+cx^2}.$$

In all these equations a , b , c denote given numbers; in the two first x is to be determined so that y may be an integer, and in the third x is to be determined so that y may be a rational quantity.

320. In the equation $y = \frac{a}{b+cx}$ it is evident $b+cx$ must be a divisor of a ; let d be one of its divisors, then $b+cx=d$, and $x = \frac{d-b}{c}$: hence, to find x we must search among the divisors of a for one such that if b be subtracted from it the remainder may be divisible by c , and the quotient will be such a value of x as is required.

321. When $y = \frac{a+bx}{c+dx}$, if d be a divisor of b , x will be taken out of the numerator if we divide it by $c+dx$, and this form is then reduced to the preceding. But if d is not a divisor of b , multiply both sides by d , then $dy = \frac{da+dbx}{c+dx}$ or $dy = b + \frac{ad-bc}{c+dx}$, and so x is found by making $c+dx$ equal to a divisor of $ad-bc$.

Example. Given $x+y+2xy=195$, to determine x and y in whole numbers.

From the given equation $y = \frac{195-x}{1+2x}$, therefore

$2y = \frac{390-2x}{1+2x} = -1 + \frac{391}{1+2x}$. Now $391 = 17 \times 23$, hence we must assume $1+2x = 17$, or $1+2x = 23$: the first supposition gives us $x=8$, $y=11$; and the second $x=11$, $y=8$, the same result in effect as the former.

322. It remains to consider the formula $y = \sqrt{a+bx+cx^2}$, where x is to be found so that y may be a rational quantity; but as the condition of having x and y also integers would add greatly to the difficulty of the problem, and produce researches of a very intricate nature, we must be satisfied for the most part with fractional values. The possibility of rendering the proposed formula a square depends altogether upon the coefficients a , b , c ; and there are four cases of the problem, the solution of each of which is connected with some peculiarity in their nature.

323. *Case 1.* Let a be a square number, then, putting g^2 for a , we have $y = \sqrt{g^2+bx+cx^2}$. Suppose $\sqrt{g^2+bx+cx^2} = g+mx$; then $g^2+bx+cx^2 = g^2+2gmx+m^2x^2$, or $bx+cx^2 = 2gmx+m^2x^2$, that is, $b+cx = 2gm+m^2x$, hence

$$x = \frac{2gm-b}{c-m^2}, \quad y = \sqrt{g^2+bx+cx^2} = \frac{cg-bm+gm^2}{c-m^2}.$$

Here m may be any rational quantity either whole or fractional.

324. *Case 2.* Let c be a square number $=g^2$, then putting $\sqrt{a+bx+g^2x^2} = m+gx$, we find $a+bx+g^2x^2 = m^2+2mgx+g^2x^2$, or $a+bx = m^2+2mgx$, hence we find

$$x = \frac{m^2-a}{b-2mg}, \quad y = \sqrt{a+bx+g^2x^2} = \frac{bm-gm^2-ag}{b-2mg}.$$

Here m , as before, may be taken at pleasure.

325. *Case 3.* When neither a nor c are square numbers, yet, if the expression $a+bx+cx^2$ can be resolved into two simple factors, as $f+gx$ and $h+kx$, the irrationality may be taken away as follows.

Assume $\sqrt{a+bx+cx^2} = \sqrt{(f+gx)(h+kx)} = m$ ($f+gx$), then $(f+gx)(h+kx) = m^2(f+gx)^2$, or $h+kx = m^2(f+gx)$, hence we find

$$x = \frac{fm^2-h}{k-gm^2}, \quad y = \sqrt{(f+gx)(h+kx)} = \frac{(fk-gh)m}{k-gm^2}$$

and in these formulæ m may be taken at pleasure.

326. *Case 4.* The expression $a+bx+cx^2$ may be transformed into a square as often as it can be resolved into two parts, one of which is a complete square, and the other a product of two simple factors; for then it has this form, p^2+qr , where p , q , and r are quantities which contain no power of x higher than the first. Let us assume $\sqrt{p^2+qr} = p+mq$; thus we have $p^2+qr = p^2+2mpq+m^2q^2$ and $r = 2mp+m^2q$, and as this equation involves only the first power of x , we may by proper reduction obtain from it rational values of x and y , as in the three foregoing cases.

327. If we can by trials discover any one value of x which renders the expression $\sqrt{a+bx+cx^2}$ rational, we may immediately reduce the quantity under the radical sign to the above-mentioned form, and thence find a general expression from which as many more values of x may be determined as we please. Thus let us suppose that p is a value of x which satisfies the condition

determination required, and that q is the corresponding value of y , then

$$y^2 = a + bx + cx^2$$

$$q^2 = a + bq + cp^2.$$

Therefore,
 $y^2 - q^2 = b(x - p) + c(x^2 - p^2) = (b + cp + cx)(x - p)$,
 and $y = \sqrt{q^2 + (b + cp + cx)(x - p)}$. The quantity under the radical sign being now reduced to the prescribed form, it may be rendered rational by the substitution pointed out in the last article.

328. The application of the preceding general methods of resolution to any particular case is very easy; we shall therefore conclude with very few examples.

Ex. 1. It is required to find two square numbers whose sum is a given square number.

Let a^2 be the given square number, and x^2, y^2 , the numbers required. Then by the question $x^2 + y^2 = a^2$, and $y = \sqrt{a^2 - x^2}$. This equation is evidently of such a form as to be resolvable by the method employed in case 1. Accordingly, by comparing $\sqrt{a^2 - x^2}$ with the general expression $\sqrt{g^2 + bx + cx^2}$, we have $g = a$, $b = 0$, $c = -1$, and substituting these values in the formulæ of § 323, also $-n$ for $+m$, we find

$$x = \frac{2an}{n^2 + 1}, \quad y = \frac{a(n^2 - 1)}{n^2 + 1}, \text{ hence the numbers}$$

required are

$$x^2 = \frac{4a^2n^2}{(n^2 + 1)^2}, \quad y^2 = \frac{a^2(n^2 - 1)^2}{(n^2 + 1)^2}.$$

If $a = n^2 + 1$, where n is any number whatever, the square numbers x^2 and y^2 will both be integers, viz. $x^2 = 4n^2$ and $y^2 = (n^2 - 1)^2$. Let us suppose $n = 2$, then $a = n^2 + 1 = 5$, and $a^2 = 25$, hence $x^2 = 4n^2 = 16$, $y^2 = (n^2 - 1)^2 = 9$. Thus it appears that the square number 25 may be resolved into two other square numbers 9 and 16.

Ex. 2. It is required to find two square numbers whose difference shall be equal to a given square number b^2 .

This question may be resolved in the same manner as the last. Or, without referring to any former investigation, let $(x + n)^2$ and x^2 be the numbers sought, then $(x + n)^2 - x^2 = b^2$, that is, $2nx + n^2 = b^2$, hence $x = \frac{b^2 - n^2}{2n}$ and $x + n = \frac{b^2 + n^2}{2n}$. So that the numbers sought are

$$\frac{(b^2 + n^2)^2}{4n^2}, \quad \frac{(b^2 - n^2)^2}{4n^2},$$

where n may be any number whatever. If, for example, $b^2 = 25$ and $n = 1$, then $x = 12$ and $x + n = 13$; so that the numbers required are 144 and 169.

Ex. 3. It is required to determine x , so that $\frac{x^2 + x}{2}$ may be a rational square.

Let y be the side of the square required, then $\frac{x^2 + x}{2} = y^2$ and $4x^2 + 4x = 8y^2$. Let the first part of this equation be completed into a square by adding 1 to each side, then $4x^2 + 4x + 1 = 1 + 8y^2$, and taking the root $2x + 1 = \sqrt{1 + 8y^2}$, so that we have to make $1 + 8y^2$ a square. Assume

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$1 + 8y^2 = \left(1 + \frac{p}{q}y\right)^2 = 1 + \frac{2p}{q}y + \frac{p^2}{q^2}y^2$, then $8y = \frac{2p}{q}$ Resolution of Geometrical Problems.
 $+ \frac{p^2}{q^2}y$. Hence by proper reduction $y = \frac{2pq}{8q^2 - p^2}$, and

since $2x + 1 = \sqrt{1 + 8y^2} = \frac{8q^2 + p^2}{8q^2 - p^2}$, therefore $x = \frac{p^2}{8q^2 - p^2}$

and $\frac{x^2 + x}{2} = \frac{4p^2q^2}{(8q^2 - p^2)^2}$, a rational square as was required.

SECT. XXIII. Of the Resolution of Geometrical Problems.

329. WHEN a geometrical problem is to be resolved by algebra, the figure which is to be the subject of investigation must be drawn, so as to exhibit as well the known quantities, connected with the problem, as the unknown quantities, which are to be found. The conditions of the problem are next to be attentively considered, and such lines drawn, or produced, as may be judged necessary to its resolution. This done, the known quantities are to be denoted by symbols in the usual manner, and also such unknown quantities as can most easily be determined; which may be either those directly required, or others from which they can be readily found. We must next proceed to deduce from the known geometrical properties of the figure a series of equations, expressing the relations between the known and unknown quantities; these equations must be independent of each other, and as many in number as there are unknown quantities. Having obtained a suitable number of equations, the unknown quantities are to be determined in the same manner as in the resolution of numerical problems.

330. No general rule can be given for drawing the lines, and selecting the quantities most proper to be represented by symbols, so as to bring out the simplest conclusion; because different problems require different methods of solution. The best way to gain experience in this matter is to try the solution of the same problem in different ways, and then apply that which succeeds best to other cases of the same kind, when they afterwards occur. The following particular directions however may be of some use.

1. In preparing the figure by drawing lines, let them be either parallel or perpendicular to other lines in the figure, or so as to form similar triangles. And if an angle be given, it will be proper to let the perpendicular be opposite to that angle, and to fall from one end of a given line, if possible.

2. In selecting the quantities for which symbols are to be substituted, those are to be chosen, whether required or not, which lie nearest the known or given parts of the figure, and by means of which the next adjacent parts may be expressed by addition and subtraction only, without the intervention of surds.

3. When two lines, or quantities, are alike related to other parts of the figure, or problem, the best way is to substitute for neither of them separately, but to substitute for their sum, or difference, or rectangle, or the sum of their alternate quotients, or some line or lines in the figure, to which they have both the same relation.

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4. When the area or the perimeter of a figure is given, or such like parts of it as have only a remote relation to the parts required, it is sometimes of use to assume another figure similar to the proposed one, having one side equal to unity, or some other known quantity. For, from hence, the other parts of the figure may be found by the known proportions of like sides or parts, and so an equation will be obtained.

331. We shall now give the algebraical solutions of some geometrical problems.

PROB. 1. In a right-angled triangle, having given the base, and the sum of the hypotenuse and perpendicular, to find both these two sides.

Let ABC (Plate XIV. fig. 1.) represent the proposed triangle, right-angled at B. Let AB, the given base, be denoted by b , and $AC+BC$, the sum of the hypotenuse and perpendicular by s ; then if x be put for BC the perpendicular, the hypotenuse AC will be $s-x$. But from the nature of a right-angled triangle $AC^2=AB^2+BC^2$, that is,

$$b^2+x^2=(s-x)^2=s^2-2sx+x^2.$$

Hence $b^2=s^2-2sx$, and $x=\frac{s^2-b^2}{2s}=BC$. Also $s-x=s-\frac{s^2-b^2}{2s}=\frac{s^2+b^2}{2s}=AC$. Thus the perpendicular and hypotenuse are expressed by means of the known quantities b and s , as required.

If a solution in numbers be required, we may suppose $AB=b=3$, and $AC+CB=s=9$, then

$$BC=\frac{s^2-b^2}{2s}=4, \text{ and } AC=\frac{s^2+b^2}{2s}=5.$$

PROB. 2. In a right-angled triangle, having given the hypotenuse, also the sum of the base and perpendicular, it is required to determine both these two sides.

Let ABC (fig. 1.) represent the proposed triangle, right-angled at B. Put $a=AC$ the given hypotenuse, and $s=AB+BC$ the given sum of the sides, then if x be put for AB, the base, $s-x$ will denote BC the perpendicular.

Now, from the nature of right-angled triangles, $AC^2=AB^2+BC^2$; therefore, $x^2+(s-x)^2=a^2$, or $x^2+s^2-2sx+x^2=a^2$; hence we have this quadratic equation $x^2-sx=\frac{a^2-s^2}{2}$, which being resolved, by complet-

ing the square, we find $x=\frac{s\pm\sqrt{2a^2-s^2}}{2}=AB$, and $s-x=\frac{s\pm\sqrt{2a^2-s^2}}{2}=BC$. Thus it appears, that either of the two quantities $\frac{s+\sqrt{2a^2-s^2}}{2}$, $\frac{s-\sqrt{2a^2-s^2}}{2}$ may be taken for AB; but whichever of the two be taken, the remaining one is necessarily equal to BC.

PROB. 3. It is required to inscribe a square in a given triangle.

Let ABC (fig. 2.) be the given triangle, and EFGH the inscribed square. Draw the perpendicular AD cut-

ting EF the side of the square in K; then, because the triangle is given, the perpendicular AD may be considered as given. Let $BC=b$, $AD=p$, and, considering AK as the unknown quantity, (because from it the square may be readily determined), let $AK=x$; then $KD=EF=p-x$.

The triangles ABC, AEF, are similar; therefore $AB:BC::AK:EF$, that is, $p:b::x:p-x$. Hence, by taking the product of the extremes and means, $p^2-px=bx$, and $x=\frac{p^2}{p+b}=AK$. If the side of the square be required, it may be immediately found by subtracting AK from AD the perpendicular. Thus we have $p-\frac{p^2}{p+b}=\frac{pb}{p+b}=KD=EF$. Hence it appears, that we may either take AK, a third proportional to AD+BC and AD, or take DK, a fourth proportional to AD+BC, AD and BC, and the point K being found, the manner of constructing the square is sufficiently obvious.

PROB. 4. Having given the area of a rectangle inscribed in a given triangle, it is required to determine the sides of the rectangle.

Let ABC (fig. 3.) be the given triangle, and EDGF the rectangle whose sides are required. Draw the perpendicular CI cutting DG in H. Put $AB=b$, $CI=p$, $DG=EF=x$, $DE=HI=y$, then $CH=p-y$. Let a^2 denote the given area.

The triangles CDG, CAB are similar; hence

$$CH:DG::CI:AB, \text{ or } p-y:x::p:b.$$

So that to determine x and y , we have these two equations,

$$xy=a^2, \quad bp-by=px.$$

From the first equation we find $y=\frac{a^2}{x}$, and from the second $y=\frac{bp-px}{b}$, therefore $\frac{bp-px}{b}=\frac{a^2}{x}$; hence $x^2-bx=-\frac{a^2b}{p}$, and, from this quadratic equation, by completing the square, &c. we find

$$x=\frac{b}{2}\pm\sqrt{\frac{b^2}{4}-\frac{a^2b}{p}}, \text{ and } y=\frac{a^2}{x}=\frac{p}{2}\pm\sqrt{\frac{p^2}{2}-\frac{pa^2}{b}}.$$

Hence it appears, that if $\frac{a^2b}{p}$ be less than $\frac{b^2}{4}$, that is, if a^2 be less than $\frac{pb}{4}$, there are two different rectangles, having the same area, which may be inscribed in the given triangle. It also appears that, to render the problem possible, the given space a^2 must not be greater than $\frac{pb}{4}$, that is, than half the area of the given triangle.

PROB. 5. In a triangle, there are given the base, the vertical angle, and the sum of the sides about that angle, to determine each of these sides.

Let us suppose that ABC (fig. 4.) is the triangle, of which there is given the base AC, the vertical angle ABC,

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ABC, and the sum of the sides AB, BC. Put $AC=a$, $AB+BC=b$, cosine of $\angle ABC=c$, and let AB, BC, the sides required, be denoted by x and y .

Let CD be drawn from either of the angles at the base perpendicular to the opposite side AB; then $\text{rad.} : \cos. B :: CB : BD$; therefore $BD = \cos. B \times CB = cy$.

Now, from the principles of geometry, $AC^2 = AB^2 + BC^2 - 2AB \times BD$. Hence, and from the question, we have these two equations,

$$x+y=b, \quad x^2-2cxy+y^2=a^2.$$

From the square of the first of these equations, viz. $x^2+2xy+y^2=b^2$, let the second be subtracted, thus we

have $2(1+c)xy = b^2 - a^2$, and $2xy = \frac{b^2 - a^2}{1+c}$. Again,

from the square of the first equation let the double of this last equation, viz. $4xy = \frac{2(b^2 - a^2)}{1+c}$, be subtracted,

and the result is $x^2 - 2xy + y^2 = \frac{2a^2 - (1+c)b^2}{1+c}$, so that

by taking the square root of this last equation we obtain

$$x-y = \sqrt{\frac{2a^2 - (1+c)b^2}{1+c}}.$$

Thus we have found the difference between the sides, now their sum is given $=b$, hence, by adding $\frac{x}{2}$ the difference to $\frac{x}{2}$ the sum, we find

$$x = \frac{b}{2} + \frac{1}{2} \sqrt{\frac{2a^2 - (1+c)b^2}{1+c}};$$

and subtracting $\frac{y}{2}$ the difference from $\frac{y}{2}$ the sum,

$$y = \frac{b}{2} - \frac{1}{2} \sqrt{\frac{2a^2 - (1+c)b^2}{1+c}}.$$

If the angle at B be a right angle, this problem becomes the same as prob. 2.

332. By a method of investigation, in all respects similar to that which has been employed in these examples, any proposed geometrical problem may be reduced to an algebraic equation, the roots of which will exhibit arithmetical values of that geometrical magnitude which constitutes the unknown quantity in the equation. But the roots of algebraic equations may also be expressed by geometrical magnitudes, and hence a geometrical construction of a problem may be derived from its algebraic solution. For example, quadratic equations, which all belong to one or other of these three forms,

$$x^2 + ax = bc, \quad x^2 - ax = bc, \quad x^2 - ax = -bc,$$

$$\text{or } x(x+a) = bc, \quad x(x-a) = bc, \quad x(a-x) = bc,$$

may be constructed as follow.

333. *Construction of the first and second forms.* Let a circle EABD (fig. 5.) be described with a radius $=\frac{1}{2}a$, in which, from any point A in the circumference apply a chord $AB=b-c$ (b being supposed greater than c) and produce AB so that $BC=c$; then $AC=b$.

Let H be the centre of the circle, join CH cutting the circumference in D and E, then, in the first case, the positive value of x shall be represented by CD, and in the second by CE. For, by construction $DE=a$, there-

fore, if CD be called x , then $CE=x+a$, but if $CE=x$, then $CD=x-a$. Now, by the elements of geometry, $EC \times CD = AC \times CB$, that is, $x(x \pm a) = bc$, or $x^2 \pm ax = bc$, which equation comprehends the first and second cases.

If the negative roots be required, that of the first case will be CE and that of the second CD.

When b and c are equal the construction will be rather more simple, for then AB vanishing, AC will coincide with the tangent CF. Therefore if a right-angled triangle HFC be constructed, whose legs HF and FC are equal respectively to $\frac{1}{2}a$ and b , then will CD, the value of x in the first case, be equal to $CH-HF$, and CE, the value of x in the latter, $=CH+HF$.

334. *Construction of the third form.*—Let a circle EADB (fig. 6) be described with a radius $=\frac{1}{2}a$ as before, in which apply a chord $AB=b+c$, and take $AC=b$. Through C draw the diameter DCE, then either DC or EC will be positive roots of the equation. For since $ED=a$, if either EC or $CD=x$, the remaining part of the diameter shall be $a-x$; now by the nature of the circle $EC \times CD = AC \times CB$, that is, $x(a-x) = bc$, or $x^2 - ax = -bc$, hence it is evident that the roots are rightly determined.

If b and c are equal the construction will be the same, only it will then not be necessary to describe the whole circle; for since AC will be perpendicular to the diameter, if a right-angled triangle HCA be constructed, having its hypotenuse $HA=\frac{1}{2}a$ and base $AC=b$, the roots of the equation will be expressed by $AH+HC$ and $AH-HC$.

335. If b and c be so unequal, that $b-c$ in the first two cases, or $b+c$ in the third, is greater than a , then, instead of these quantities, $\frac{1}{2}b$ and $2c$, or in general $\frac{b}{n}$ and nc (where n is any number whatever) may be used. Or a mean proportional may be found between b and c , and the construction performed as directed in each case when b and c are equal.

336. It appears from § 333 and 334, that every geometrical problem which produces a quadratic equation may be constructed by means of a straight line and a circle, or is a *plane* problem; hence, on the contrary, if a problem can be constructed by straight lines and circles, its algebraic resolution will not produce an equation higher than a quadratic. Cubic and biquadratic equations may be constructed geometrically by means of any two conic sections; hence it follows that every geometrical problem which requires for its construction two conic sections, will, when resolved by algebra, produce a cubic or biquadratic equation.

SECT. XXIV. Of the Loci of Equations.

337. WHEN an equation contains two indeterminate quantities x and y , then for each particular value of x there may be as many values of y as it has dimensions in that equation. So that if in an indefinite line AE (fig. 7.) there be taken a part AP to represent x , and a perpendicular PM be drawn to represent y , there will be as many points M, M', &c. the extremities of these perpendiculars, as there are dimensions of y in the proposed equation. And the values of PM, PM', &c. will be the roots of the equation which are found by substituting for x its value in any particular

Loci of Equations. Hence it appears that in any particular equation we may determine as many points M , as we please, and a line which passes through all these points is called the *locus* of the equation. The line AP which expresses any value of x is called an *absciss*; and PM which expresses the corresponding value of y is called an *ordinate*. Any two corresponding values of x and y are also called *co-ordinates*.

338. When the equation that arises by substituting for x any particular value AP has all its roots positive, the points $M, M', \&c.$ will lie all on one side of AE ; but if any of them be negative, these must be set off on the other side of AE towards m .

If x be supposed to become negative, then the line Ap which represents it is to be taken in a direction the opposite to that which represents the positive values of x ; the points M, m , are to be taken as before, and the *locus* is only complete when it passes through all the points M, m , so as to exhibit a value of y corresponding to every possible value of x .

If in any case one of the values of y vanish, then the point M coincides with P , and the *locus* meets AE in that point. If one of the values of y becomes infinite, then it shews that the curve has an infinite arc, and in that case the line PM becomes an *asymptote* to the curve, or touches it at an infinite distance, if AP itself is finite.

If when x is supposed infinitely great, a value of y vanish, then the curve approaches to AE as an *asymptote*.

If any values of y become impossible, then so many points M vanish.

339. From these observations and the theory of equations, it appears that when an equation is proposed involving two indeterminate quantities x and y , there may be as many intersections of the curve that is the *locus* of the equation and of the line PM , as there are dimensions of y in the equation; and as many intersections of the curve and the line AE as there are dimensions of x in the equation.

340. A curve line is called *geometrical* or *algebraic*, when the equation which expresses the relation between x and y , any absciss and its corresponding ordinate, consists of a finite number of terms, and contains besides these quantities only known quantities. Algebraic curves are divided into *orders* according to the dimensions of the equations which express the relations between their abscisses and ordinates, or according to the number of points in which they can intersect a straight line.

341. *Straight lines* themselves constitute the first order of lines, and when the equation expressing the relation between x and y is only of one dimension, the points M must be all found in a straight line which contains with AE a given angle. Suppose for example that the given equation is $ay - bx - cd = 0$, and that its *locus* is required.

Since $y = \frac{bx + cd}{a}$, it follows that APM (fig. 8.)

being a right angle, if AN be drawn making the angle NAP such that its cosine is to its sine as a to b , and drawing AD parallel to the ordinates PM , and equal to $\frac{cd}{a}$, if DF be drawn parallel to AN , then will DF

be the *locus* required; where it is to be observed that AD and PN are to be taken on the same side of AE if bx and cd have the same sign, but on opposite sides of AE if they have contrary signs.

342. These curves whose equations are of two dimensions constitute the *second* order of lines, and the *first* kind of curves. Their intersections with a straight line can never exceed two (§ 339.)

The curves whose equations are of three dimensions form the *third* order of lines, and the *second* kind of curves; and their intersections with a straight line can never exceed three, and after the same manner curves of the higher orders are denominated.

Some curves, if they were completely described, would cut a straight line in an infinite number of points, but these belong to none of the orders we have mentioned, for the relation between their ordinates and abscisses cannot be expressed by a finite equation, involving only ordinates and abscisses with determinate quantities. Curves of this kind are called *mechanical* or *transcendental*.

343. As the roots of an equation become impossible always in pairs, so the intersection of a curve and its ordinate PM must vanish in pairs if any of them vanish. Let PM (fig. 9.) cut the curve in the points M and m , and by moving parallel to itself come to touch it in the point N , then the two points of intersection M and m go to form one point of contact N . If PM still move on parallel to itself, the points of intersection will beyond N become imaginary, as the two roots of an equation first become equal and then imaginary.

344. The curves of the 3d, 5th, 7th, orders, and all whose dimensions are odd numbers, have always one real root at least, and consequently for every value of x the equation by which y is determined must have at least one real root; so that as x , or AP , may be increased *in infinitum* on both sides, it follows that M must go off *in infinitum* on both sides without limit.

In curves whose dimensions are even numbers, as the roots of their equations may become all impossible, it follows that the figure of the curve may be like a circle or oval that is limited within certain bounds, beyond which it cannot extend.

345. When two roots of the equation by which y is determined become equal, either the ordinate PM touches the curve, two points of intersection in that case going into a point of contact, or the point M is a *punctum duplex* in the curve, two of its arcs intersecting each other there; or some oval that belongs to that kind of curve becoming infinitely little in M , it vanishes into what is called a *punctum conjugatum*.

If in the equation y be supposed $= 0$, then the roots of the equation by which x is determined, will give the distances of the points where the curve meets AE from A , and if two of those roots be found equal, then either the curve touches the line AE , or AE passes through a *punctum duplex* in the curve. When y is supposed $= 0$, if one of the values of x vanish, the curve in that case passes through A . If two vanish, then either AE touches the curve in A , or A is a *punctum duplex*.

As a *punctum duplex* is determined from the equality of two roots, so is a *punctum triplex* from the equality of three roots.

346. To

Loci of equations. 346. To illustrate these observations we shall take a few examples.

Loci of Equations.

Ex. 1. It is required to describe the line that is the *locus* of this equation, $y^2 = ax + ab$, or $y^2 - ax - ab = 0$, where a and b denote given quantities. Since $y^2 = \pm \sqrt{ax + ab}$, if $AP = x$ (fig. 10.) be assumed of a known value, and PM, Pm set off on each side equal to $\sqrt{ax + ab}$, the points M, m will belong to the locus required; and for every positive value of AP there may thus be found a point of the locus on each side. The greater AP , or x , is taken, the greater does $\sqrt{ax + ab}$ become, and consequently PM and Pm the greater, and if AP be supposed infinitely great, PM and Pm will also become infinitely great, therefore the locus has two infinite arcs that go off to an infinite distance from AE and from AD . If x be supposed to vanish, then $y = \pm \sqrt{ab}$, so that y does not vanish in that case, but passes through D and d , taking AD and Ad each $= \sqrt{ab}$.

If P be supposed to move to the other side of A , then x becomes negative, and $y = \pm \sqrt{ab - ax}$, so that y will have two values as before, while x is less than b ; but if $AB = b$, and the point P be supposed to come to B , then $ab = ax$, and $y = \pm \sqrt{ab - ax} = 0$; that is, PM and Pm vanish, and the curve there meets the line AE . If P be supposed to move from A beyond B , then x becomes greater than b , and ax greater than ab , so that $ab - ax$ being negative, $\sqrt{ab - ax}$ becomes imaginary; that is, beyond B there are no ordinates which meet the curve, and consequently on that side the curve is limited in B .

All this agrees very well with what is known by other methods, that the curve whose equation is $y^2 = ax + ab$ is a parabola whose vertex is B , axis BE , and parameter equal to a . For since $b \pm x = BP$ and $y = PM$, from the equation $ab \pm ax = y^2$, or $a(b \pm x) = y^2$, we have $a \times BP = PM^2$, which is the well-known property of the parabola.

Ex. 2. It is required to describe the line that is the *locus* of the equation $xy + ay + cy = bc + bx$,

$$\text{or } y = \frac{bc + bx}{a + c + x}.$$

Here it is evident (fig. 11.) that the ordinate PM can meet the curve in one point only, there being but one value of y corresponding to each value of x . When

$x = 0$, then $y = \frac{bc}{a + c}$, so that the curve does not pass

through A . If x be supposed to increase, then y will increase, but will never become equal to b , since $y = b$

$\times \frac{c + x}{a + c + x}$, and $a + c + x$ is always greater than $c + x$.

If x be supposed infinite, then the terms a and c vanish

compared with x , and consequently $y = b \times \frac{x}{x} = b$; from

which it appears, that taking $AD = b$, and drawing GD parallel to AE , it will be an *asymptote*, and touch the curve at an infinite distance. If x be now supposed negative, and AP be taken on the other side of A ,

then $y = b \times \frac{c - x}{a + c - x}$, and if x be taken on that side

$= c$, then $y = b \times \frac{c - c}{a} = 0$, so that the curve must pass

through B if $AB = c$. If x be supposed greater than c , then will $c - x$ become negative, and the ordinate will become negative, and lie on the other side of AE ,

till x become equal to $a + c$, and then $y = b \times \frac{a}{0}$, that

is, because the denominator is 0, x becomes *infinite*, so that if AK be taken $= a + c$, the ordinate K_4 will be an asymptote to the curve.

If x be taken greater than $a + c$ or AP greater than AK , then both $c - x$ and $a + c - x$ become negative,

and consequently $y = b \times \frac{x - c}{x - a - c}$ becomes a positive

quantity; and since $x - c$ is always greater than $x - a - c$, it follows that y will be always greater than b or KG , and consequently the rest of the curve lies in the angle FGH . And as x increases, since the ratio of $x - c$ to $x - a - c$ approaches still nearer to a ratio of equality, it follows that PM approaches to an equality with PN , therefore the curve approaches to its asymptote GH on that side also.

The curve is the common hyperbola, for since $b(c + x) = y(a + c + x)$, by adding ab to both sides, $b(a + c + x) = y(a + c + x) + ab$, and $(b - y)(a + c + x) = ab$, that is $NM \times GN = GC \times BC$, which is the property of the common hyperbola.

Ex. 3. It is required to describe the *locus* of the equation $ay^2 - xy^2 = x^3 + bx^2$.

$$\text{Here } y^2 = \frac{x^3 + bx^2}{a - x}, \text{ and therefore } y = \pm \sqrt{\frac{x^3 + bx^2}{a - x}},$$

hence PM and PM (fig. 12.) are to be taken on each

side, and equal to $\sqrt{\frac{x^3 + bx^2}{a - x}}$; this expression, by sup-

posing $x = a$, becomes infinite because its denominator is then $= 0$, therefore if AB be taken $= a$, and BK be drawn perpendicular to AB , the line BK shall be an asymptote to the curve. If x be supposed greater than a , or AP greater than AB , then $a - x$ being negative,

the fraction $\frac{x^3 + bx^2}{a - x}$ will become negative, and its square

root impossible; so that no part of the locus can lie beyond B . If x be supposed negative, or P taken on

the other side of A , then $y = \pm \sqrt{\frac{-x^3 + bx^2}{c + x}}$, hence

the values of y will be real and equal as long as x is

less than b , but if $x = b$, then $y = \sqrt{\frac{-x^3 + bx^2}{a - x}}$

$= \sqrt{\frac{-b^3 + b^3}{a - b}} = 0$, and consequently if AD be taken

$= b$, the curve will pass through D , and there touch the

Loci of the ordinate. If x be taken greater than b , then Equations. $\pm \sqrt{\frac{-x^3 - ax^2}{c + x}}$ becomes imaginary, so that no part of

the curve is found beyond D. The portion between A and D is called a *nodus*. If y be supposed $= 0$, then will $x^3 + bx^2 = 0$ be an equation whose roots are $-b, 0, 0$, from which it appears that the curve passes twice through A, and has in A a *punctum duplex*. This locus is a line of the third order.

If b is supposed to vanish in the proposed equation, so that $ay^2 - xy^2 = x^3$, then will A and D coincide (fig. 13.) and the *nodus* vanish, and the curve will have in the point A a *cuspid*, the two arcs AM and Am, in this case, touching one another in that point. This is the same curve which the ancients called the *Cissoïd of Diocles*.

If instead of supposing b positive, or equal to 0, we suppose it negative, the equation will be $ay^2 - xy^2 = x^3 - bx^2$, the curve will in this case pass through D as before (fig. 14.), and taking $AB = a$, BK will be its asymptote. It will have a *punctum conjugatum* in A, because when y vanishes two values of x vanish, and the third becomes $= b$ or AD. The whole curve, besides this point, lies between DQ and BK. These remarks are demonstrated after the same manner as in the first case.

347. If an equation have this form,

$$y = ax^n + bx^{n-1} + cx^{n-2} + \dots$$

and n is an even number, then will the *locus* of the equation have two infinite arcs lying on the same side of AE (fig. 13.): for if x become infinite, whether positive or negative, x^n will be positive and ax^n have the same sign in either case; and as ax^n becomes infinitely greater than the other terms bx^{n-1} , &c. it follows that the infinite values of y will have the same sign in these cases, and consequently the two infinite arcs of the curve will lie on the same side of AE.

But if n be an odd number, then when x is negative x^n will be negative, and ax^n will have the contrary sign to what it had when x is positive, and therefore the two infinite arcs will in this case lie on different sides of AE, as in fig. 16. and tend towards parts directly opposite.

348. If an equation have this form, $yx^n = a^{n+1}$, and

n be an odd number, then when x is positive $y = \frac{a^{n+1}}{x^n}$,

but when x is negative $y = -\frac{a^{n+1}}{x^n}$; so that this curve

must all lie in the vertically opposite angles KAE, FAe, (fig. 17.) as the common hyperbola, FK, Ee being asymptotes.

But if n be an even number, then y is always positive whether x be positive or negative, because x^n in this case is always positive, and therefore the curve must all lie in the two adjacent angles KAE and KAE (fig. 18.) and have AK and AE for its asymptotes.

349. If an equation be such as can be reduced into two other equations of lower dimensions, without affecting y or x with any radical sign, then the *locus* shall consist of the two *loci* of those inferior equations. Thus the locus of the equation $y^2 - 2xy + by + x^2 - bx = 0$,

which may be resolved into these two, $x - y = 0$, $y - x + b = 0$, is found to be two straight lines cutting the absciss AE (fig. 19.) in angles of 45° in the points A, B, whose distance $AB = b$. In like manner some cubic equations can be resolved into three simple equations, and then the *locus* is three straight lines, or may be resolved into a quadratic and simple equation, and then the locus is a straight line and a conic section. In general, curves of the superior orders include all the curves of the inferior orders, and what is demonstrated generally of any one order is also true of the inferior orders. Thus, for example, any general property of the conic sections holds true of two straight lines as well as a conic section, particularly that the rectangles of the segments of parallels bounded by them will always be to one another in a given ratio.

350. From the analogy which subsists between algebraic equations and geometrical curves, it is easy to see that the properties of the former must suggest corresponding properties of the latter. Hence the principles of algebra admit of the most extensive application to the theory of curve lines. It may be demonstrated, for example, that the *locus* of every equation of the second order is a conic section; and, on the contrary, the various properties of the diameters, ordinates, tangents, &c. of the conic sections may be readily deduced from the theory of equations.

SECT. XXV. Of the Arithmetic of Sines.

351. THE relations which subsist between the sines and cosines of any arches of a circle, and those of their sums, or differences, &c. constitute what is called the *arithmetic of sines*. This branch of calculation has its origin in the application of algebra to geometry, and is of great importance in the more difficult parts of the mathematics, as well as in their application to physics.

352. In treating this subject, it is necessary to attend to the following observations.

1. If the sines of all arches between 0° and 180° be supposed positive, the sines of arches between 180° and 360° must be considered as negative; again, the sines of arches between 360° and 540° will be positive, and those of arches between 540° and 720° negative, and so on.

2. If the cosines of arches between 0° and 90° be supposed positive, the cosines of arches between 90° and 270° must be considered as negative, and the cosines of arches between 270° and 450° positive, and so on.

3. When an arch changes from $+$ to $-$, or from $-$ to $+$, its sine undergoes a like change, but its cosine is the same as before.

The truth of these observations must be evident from this consideration, that when a line, taken in a certain direction, decreases till it becomes $= 0$, and afterwards increases, but in a contrary direction; then, if in the former state it was considered as positive, it must be negative in the latter, and contrariwise.

353. The following proposition may be considered as the foundation of the arithmetic of sines.

Let a and b denote any two arches of a circle.

Then, if radius be supposed $= 1$,

$$\sin. (a + b) = \sin a \times \cos. b + \cos. a \times \sin. b.$$

Let

Let C be the centre of the circle (fig. 20.), and AB, BD the arches denoted by a and b ; then $AD = a + b$: draw the radii CA, CB, CD, and the sines BE, BF, DG; then BE, BF, DG, are the sines of a , b , and $a + b$, respectively; and CE, CF, CG their cosines. Join EF, and draw FH parallel to DG. Because the angles CEB, CFB are right angles, the points C, E, B, F are in the circumference of a circle, hence the angle FCB is equal to FEB; that is, to the alternate angle EFH; now CFB, EHF are both right angles, therefore the triangles CFB, EHF are similar, hence $CF : CB (=CD) :: FH : FE$; but $CF : CD :: FH : DG$; therefore $FH : FE :: FH : DG$, hence $FE = DG = \sin. (a + b)$. Because EBFC is a quadrilateral inscribed in a circle, from the elements of geometry, we have $BC \times EF = BE \times CF + BF \times CE$; but $BE = \sin. a$, $CF = \cos. b$, $BF = \sin. b$, $CE = \cos. a$, $BC = 1$, and $EF = DG = \sin. (a + b)$, therefore $\sin. (a + b) = \sin. a \times \cos. b + \sin. a \times \sin. b$, as was to be proved.

354. If in the preceding theorem we suppose the arch b to become negative, then $\sin. b$ will also become negative. Thus we obtain a second theorem, viz.

$$\sin. (a - b) = \sin. a \times \cos. b - \cos. a \times \sin. b.$$

Because $\cos. (a + b) = \sin. (90^\circ - a - b)$, and by the second theorem $\sin. ((90^\circ - a) - b) = \sin. (90^\circ - a) \times \cos. b - \cos. (90^\circ - a) \times \sin. b = \cos. a \times \cos. b - \sin. a \times \sin. b$, therefore

$$\text{Theor. IX. } 2 \cos. a \times \sin. na = \sin. (n + 1) a + \sin. (n - 1) a$$

$$\text{Theor. X. } 2 \sin. a \times \cos. na = \sin. (n + 1) a - \sin. (n - 1) a$$

$$\text{Theor. XI. } 2 \cos. a \times \cos. na = \cos. (n + 1) a + \cos. (n - 1) a$$

$$\text{Theor. XII. } 2 \sin. a \times \sin. na = -\cos. (n + 1) a + \cos. (n - 1) a$$

356. By means of the four last theorems, the powers and products of the sines and cosines of arches may be expressed in terms of the sums and differences of certain multiples of those arches.

Thus, if in Theor. XII. we suppose $n = 1$, it becomes

$$2 \sin. a = -\cos. 2a + 1.$$

To find the third power of $\sin. a$, let both sides of this equation be multiplied by $2 \sin. a$, then $4 \sin. a^3 = 2 \sin. a (-\cos. 2a + 1)$, but $2 \sin. a \times \cos. 2a = \sin. 3a - \sin. a$, Theor. X. Therefore

$$4 \sin. a^3 = -\sin. 3a + 3 \sin. a.$$

Again, for the fourth power, let both sides of the last equation be multiplied by $2 \sin. a$, then $8 \sin. a^4 = 2 \sin. a (-\sin. 3a + 3 \sin. a)$; but $2 \sin. a \times \sin. 3a = -\cos. 4a + \cos. 2a$, and $2 \sin. a \times \sin. a = -\cos. 2a + 1$, Theor. XII. therefore by substitution

$$8 \sin. a^4 = \cos. 4a - 4 \cos. 2a + 3.$$

Proceeding in this way the successive powers of $\sin. a$ may be calculated as in the following table:

$$\begin{aligned} \sin. a &= \sin. a \\ 2 \sin. a^2 &= -\cos. 2a + 1 \\ 4 \sin. a^3 &= -\sin. 3a + 3 \sin. a \\ 8 \sin. a^4 &= \cos. 4a - 4 \cos. 2a + 3 \\ 16 \sin. a^5 &= \sin. 5a - 5 \sin. 3a + 10 \sin. a \\ 32 \sin. a^6 &= -\cos. 6a + 6 \cos. 4a - 15 \cos. 2a + 10 \\ 64 \sin. a^7 &= -\sin. 7a + 7 \sin. 5a - 21 \sin. 3a + 35 \sin. a \\ &\&c. \end{aligned}$$

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of Sines.

$\cos. (a + b) = \cos. a \times \cos. b - \sin. a \times \sin. b$,
which is the third theorem.

If we now suppose b to become negative, then $\sin. b$ becomes also negative; thus we have

$$\text{Theor. IV. } \cos. (a - b) = \cos. a \times \cos. b + \sin. a \times \sin. b.$$

355. We have found that $\sin. (a + b) = \sin. a \times \cos. b + \cos. a \times \sin. b$; also, that $\sin. (a - b) = \sin. a \times \cos. b - \cos. a \times \sin. b$, therefore, taking the sum of these two equations, we find

$$\text{Theor. V. } \sin. (a + b) + \sin. (a - b) = 2 \sin. a \times \cos. b.$$

In like manner, by taking the difference between the equations, we have

$$\text{Theor. VI. } \sin. (a + b) - \sin. (a - b) = 2 \cos. a \times \sin. b.$$

And, by taking the sum and difference of the equations, which constitute the third and fourth theorems, we also have

$$\text{Theor. VII. } \cos. (a - b) + \cos. (a + b) = 2 \cos. a \times \cos. b.$$

$$\text{Theor. VIII. } \cos. (a - b) - \cos. (a + b) = 2 \sin. a \times \sin. b.$$

If in the four last theorems we substitute na for a , and a for b , we derive from them these other four:

The

The successive powers of the cosines may be found in the same manner. Thus

$$\begin{aligned}\text{Cos. } a &= \text{cos. } a \\ 2 \text{ Cos. } a &= \text{cos. } 2a + 1 \\ 4 \text{ Cos. } a &= \text{cos. } 3a + 3 \text{ cos. } a \\ 8 \text{ Cos. } a &= \text{cos. } 4a + 4 \text{ cos. } 2a + 3 \\ 16 \text{ Cos. } a &= \text{cos. } 5a + 5 \text{ cos. } 3a + 10 \text{ cos. } a \\ 32 \text{ Cos. } a &= \text{cos. } 6a + 6 \text{ cos. } 4a + 15 \text{ cos. } 2a + 10 \\ 64 \text{ Cos. } a &= \text{cos. } 7a + 7 \text{ cos. } 5a + 21 \text{ cos. } 3a + 35 \text{ cos. } a \\ &\&c.\end{aligned}$$

357. As an example of the products of the sines and cosines of an arch, let it be proposed to express $\sin. a \times \cos. a$ by the sines or cosines of multiples of a . We have already found $4 \sin. a = 3 \sin. 3a + 3 \sin. a$, therefore

$$16 \sin. a \times \cos. a \begin{cases} = 2 \cos. a \times 2 \cos. a (-3 \sin. 3a + 3 \sin. a) \\ = 2 \cos. a (-\sin. 4a + 2 \sin. 2a) \\ = -\sin. 5a + \sin. 3a + 2 \sin. a. \end{cases}$$

Thus it appears that all positive integer powers of the sine and cosine of an arch, or any product of those powers, may be expressed in finite terms by the sines and cosines of multiples of that arch.

358. On the contrary, the sine and cosine of any arch may be expressed by the powers of the sine and cosine of any arch whereof it is a multiple. For it appears from the 9th and 11th theorems that

$$\begin{aligned}\text{Sin. } (n+1)a &= 2 \cos. a \times \sin. na - \sin. (n-1)a, \\ \text{Cos. } (n+1)a &= 2 \cos. a \times \cos. na - \cos. (n-1)a,\end{aligned}$$

therefore, by taking $n=0, 1, 2, 3, \&c.$ successively, we have

$$\begin{aligned}\text{Sin. } a &= \sin. a \\ \text{Sin. } 2a &= 2 \cos. a \times \sin. a \\ \text{Sin. } 3a &= 2 \cos. a \times \sin. 2a - \sin. a \\ \text{Sin. } 4a &= 2 \cos. a \times \sin. 3a - \sin. 2a \\ \text{Sin. } 5a &= 2 \cos. a \times \sin. 4a - \sin. 3a, \\ &\&c.\end{aligned}$$

$$\begin{aligned}\text{Cos. } a &= \cos. a \\ \text{Cos. } 2a &= 2 \cos. a \times \cos. a - 1 \\ \text{Cos. } 3a &= 2 \cos. a \times \cos. 2a - \cos. a \\ \text{Cos. } 4a &= 2 \cos. a \times \cos. 3a - \cos. 2a \\ \text{Cos. } 5a &= 2 \cos. a \times \cos. 4a - \cos. 3a, \\ &\&c.\end{aligned}$$

So that, putting s for the sine, and c for the cosine of the arch a , and remarking that $c^2 = 1 - s^2$.

$$\begin{aligned}\text{Sin. } a &= s \\ \text{Sin. } 2a &= 2cs \\ \text{Sin. } 3a &= 4c^3s - s = -4s^3 + 3s \\ \text{Sin. } 4a &= 8c^3s - 4cs = c(-8s^3 + 4s) \\ \text{Sin. } 5a &= 16c^4s - 12c^2s + s = 16s^5 - 20s^3 + 5s, \\ &\&c.\end{aligned}$$

$$\begin{aligned}\text{Cos. } a &= c \\ \text{Cos. } 2a &= 2c^2 - 1 \\ \text{Cos. } 3a &= 4c^3 - 3c \\ \text{Cos. } 4a &= 8c^4 - 8c^2 + 1 \\ \text{Cos. } 5a &= 16c^5 - 20c^3 + 5c, \\ &\&c.\end{aligned}$$

359. It it be required to find the sine or cosine of an arch, from having given the sine or cosine of some

multiple of that arch, it may be found by resolving an equation of an order denoted by the numerical coefficient of the multiple arch. Thus if the cosine of an arch be given, to determine the cosine of half the arch, let C denote the given cosine, and x that which is required, then the equation $\cos. 2a = 2x^2 - 1$ becomes $C = 2x^2 - 1$, which equation being resolved, gives

$$x = \pm \sqrt{\frac{1+C}{2}}. \text{ If the sine be required, from that of twice the arch being given, it may be found from the equation } \sin. 2a = 2cs, \text{ which, by putting } S \text{ for the given sine, and } y \text{ for the sine required, becomes } S = 2y\sqrt{1-y^2}, \text{ or, by squaring both sides, and reducing, } y^4 - y^2 = -\frac{S^2}{4}; \text{ whence } y^2 = \frac{1 \pm \sqrt{1-S^2}}{2}, \text{ and } y = \pm \sqrt{\frac{1 \pm \sqrt{1-S^2}}{2}}.$$

The two values of x indicate that there are two arches, the one as much less than 90° , as the other exceeds 90° , such, that the cosine of the double of each is expressed by the same number. And the four values of y shew that there are four arches, viz. two positive and two negative, such, that the sine of the double of each is expressed by the same number.

Suppose now that the cosine of an arch is given to find the cosine of one-third of that arch, then, putting C to denote the given cosine, and x that which is required, the equation to be resolved is

$$4x^3 - 3x = C, \text{ or } x^3 - \frac{3}{4}x - \frac{C}{4} = 0.$$

By comparing this cubic equation with the general equation $x^3 + qx + r = 0$, it appears that q is negative and such that $4q^3 > 27r^2$, for C is always less than unity; hence it follows that the equation belongs to the *irreducible* case, or that which cannot be resolved by Cardan's rule. The equation $4 \sin. a = 3 \sin. 3a$ is also of the same form; in order, therefore, to find either the sine or cosine of one-third of a given arch, recourse must be had to the methods of approximation explained in Sect. XVI.

360. The sum of any powers of the sines or cosines of arches which constitute the arithmetical progression $a, a+d, a+2d, a+3d, \&c.$ to $a+nd$, may be

Arithmetic be found as follows. We have already found, therefore, by substituting $a, a+d, a+2d, \&c.$ successively for p , we obtain the following series of equations: Arithmetic of Sines.

$$\text{Sin. } (p+d) = 2 \cos. d \times \sin. p - \sin. (p-d);$$

$$\begin{aligned} \text{Sin. } a &= \sin. a \\ \text{Sin. } (a+d) &= 2 \cos. d \times \sin. a - \sin. (a-d) \\ \text{Sin. } (a+2d) &= 2 \cos. d \times \sin. (a+d) - \sin. a \\ \text{Sin. } (a+3d) &= 2 \cos. d \times \sin. (a+2d) - \sin. (a+d), \\ &\&c. \end{aligned}$$

$$\begin{aligned} \text{Sin. } (a+nd) &= 2 \cos. d \times \sin. (a+(n-1)d) - \sin. (a+(n-2)d) \\ \text{Sin. } (a+(n+1)d) &= 2 \cos. d \times \sin. (a+nd) - \sin. (a+(n-1)d); \end{aligned}$$

Therefore, if we substitute

$$S = \sin. a + \sin. (a+d) + \sin. (a+2d), \&c. + \sin. (a+nd),$$

by taking the sum of all the equations, it is evident that

$$S + \sin. (a+(n+1)d) = \sin. a + 2 \cos. d \times S - \sin. (a-d) - (S - \sin. (a+nd)),$$

which equation, by proper reduction, becomes

$$S = \frac{\sin. a - \sin. (a+(n+1)d) + \sin. (a+nd) - \sin. (a-d)}{2(1 - \cos. d)}.$$

By proceeding in the same manner with Theor. VII. viz.

$$\cos. (p+d) = 2 \cos. d \times \cos. p - \cos. (p-d),$$

and substituting $a, a+d, a+2d, \&c.$ successively for p ; also putting

$$C = \cos. a + \cos. (a+d) + \cos. (a+2d) +, \&c. + \cos. (a+nd),$$

we obtain this other theorem

$$C = \frac{\cos. a - \cos. (a+(n+1)d) + \cos. (a+nd) - \cos. (a-d)}{2(1 - \cos. d)}.$$

361. It is worthy of remark, that if the arch d is contained $n+1$ times, either in the whole circumference, or any number of circumferences, that is, if $(n+1)d = q \times 360^\circ$, where q is any whole number; then $nd = q \times 360^\circ - d$. Thus we have $\sin. (a+(n+1)d) = \sin. (a+q \times 360^\circ) = \sin. a$, also $\sin. (a+nd) = \sin. (a-d+q \times 360^\circ) = \sin. (a-d)$; for the sine of any arch is equal to the sine of the same arch increased by any number of circumferences, and the same is true also of the cosine of an arch. Hence it appears that in these circumstances the terms in the numerators of the fractions, which are equal to S and C , destroy one another, and thus S and C are both $= 0$; that is, the positive sines, and cosines, are equal to the negative sines, and cosines, respectively. Now if the circumference of a circle be divided into $n+1$ equal parts at the points $A, A', A'', A''', \&c.$ (fig. 21.), and any diameter BC drawn, then, if the arch $BA = a$, and the arch $AA' = d$, the arches $BAA', BAA'A'', \&c.$ will be equal to $a+d, a+2d, \&c.$ respectively; and, supposing the extremity of the diameter to fall between A and A^{iv} , the arch $BA, \&c. A^{iv}$ will be equal to $a+nd$. Hence we derive the following remarkable

property of the circle. Let the circumference of a circle be divided into any number of equal parts at the points $A, A', A'', \&c.$; and from the points of division let the sines $AD, A'D', A''D'', \&c.$ be drawn upon any diameter BCE ; then, the sum of $AD, A'D', \&c.$ the sines on one side of the diameter, shall be equal to the sum of $A''D'', A'''D''', \&c.$ the sines on the other side of the diameter. Also the sum of $CD, C'D', \&c.$ the cosines on the side of the centre shall be equal to the sum of $C'D', C''D'', \&c.$ the cosines on the other side of the centre.

362. Let us next investigate the sum of the squares of the sines of the arches $a, a+d, a+2d, \&c.$ For this purpose we may form a series of equations from the theorem

$$2 \sin.^2 a = 1 - \cos. 2a.$$

Thus we have

$$\begin{aligned} 2 \sin.^2 a &= 1 - \cos. 2a \\ 2 \sin.^2 (a+d) &= 1 - \cos. 2(a+d) \\ 2 \sin.^2 (a+2d) &= 1 - \cos. 2(a+2d), \\ &\&c. \\ 2 \sin.^2 (a+nd) &= 1 - \cos. 2(a+nd) \end{aligned}$$

Let

Let $S' = \sin.^2 a + \sin.^2 (a+d) + \sin.^2 (a+2d) + \&c. + \sin.^2 (a+nd)$,

Then by addition, and observing that $\cos. 2a + \cos. 2(a+d) + \&c. + \cos. 2(a+nd)$ is, by § 360,

$$= \frac{\cos. 2a - \cos. 2(a+(n+1)d) + \cos. 2(a+nd) - \cos. 2(a-d)}{2(1 - \cos. 2d)},$$

we have

$$2S' = n + \frac{\cos. 2a - \cos. 2(a+(n+1)d) + \cos. 2(a+nd) - \cos. 2(a-d)}{2(1 - \cos. 2d)},$$

In the same manner, by forming a series of equations from this theorem, $2 \cos.^2 a = 1 + \cos. 2a$, and, putting

$$\cos.^2 a + \cos.^2 (a+d) + \cos.^2 (a+2d) + \&c. + \cos.^2 (a+nd),$$

we find

$$2C' = n + \frac{\cos. 2a - \cos. 2(a+(n+1)d) + \cos. 2(a+nd) - \cos. 2(a-d)}{2(1 - \cos. 2d)}.$$

363. If we now suppose d to be such an arch that $(d+1)d =$ the whole circumference $= 360^\circ$, then $\cos. 2(a+(n+1)d) = \cos. (2a+2 \times 360^\circ) = \cos. 2a$, also $\cos. 2(a+nd) = \cos. (2(a-d)+2 \times 360^\circ) = \cos. 2(a-d)$. Thus it appears, that in this particular case the numerators of the fractional parts of the values of $2S'$ and $2C'$ are each $= 0$; and hence $2S'$ and $2C'$ are each $= n$. We must except, however, the case of $n=1$, for then $d=180^\circ$, and $\cos. 2d=1$, so that the denominator of each fraction vanishing, as well as the numerator, it would be wrong to conclude that the fractions themselves vanish.

Now if the circumference of a circle be divided into $n+1$ equal parts at the points, $A, A', A'', \&c.$ (fig. 21.), and any diameter BE , as also the sines $AD, A'D', A''D'', \&c.$ be drawn, then, if the arch $BA=a$, and the arch $AA'=d$, we have, as in § 361, $AD=\sin. a$, $A'D'=\sin. (a+d)$, $A''D''=\sin. (a+2d)$, $\&c.$ and, supposing the point B to fall between A and A^{iv} , $A^{iv}D^{iv}=\sin. (a+nd)$. Hence we derive the following very elegant and general theorem relating to the circle.

Let the circumference of a circle be divided into n equal parts (where n is any greater number than 2), at the points $A, A', A'', \&c.$; and from the points of division let the sines $AD, A'D', A''D'', \&c.$ be drawn perpendicular to any diameter whatever. Twice the sum of the squares of the sines $AD, A'D', A''D'', \&c.$ is equal to n times the square of the radius of the circle. Also twice the sum of the squares of the cosines $CD, CD', CD'', \&c.$ is equal to n times the square of the radius of the circle.

364. We might now proceed to find the sum of the cubes of the sines of the arches $a, a+d, a+2d, \&c.$ from the equation

$$\begin{aligned} \text{ch. } (n+1)a &= \text{ch. sup. } a \times \text{ch. } na - \text{ch. } (n-1)a \\ \text{ch. sup. } (n+1)a &= \text{ch. sup. } a \times \text{ch. sup. } na - \text{ch. sup. } (n-1)a \end{aligned}$$

367. Let $x =$ chord of a , and $y =$ chord of its supplement, then putting 0, 1, 2, 3, $\&c.$ successively for n , and observing that $\text{ch. } 0 = 0$, we obtain from the first of these theorems the following series of equations:

$$\begin{aligned} \text{ch. } a &= x \\ \text{ch. } 2a &= xy \\ \text{ch. } 3a &= x(y^2 - 1) \\ \text{ch. } 4a &= x(y^3 - 2y) \\ \text{ch. } 5a &= x(y^4 - y^2 + 1) \\ \text{ch. } 6a &= x(y^5 - y^3 + 3y) \\ \text{ch. } 7a &= x(y^6 - 5y^4 + 6y^2 - 1), \\ &\&c. \end{aligned}$$

$$4 \sin.^3 a = 3 \sin. a - \sin. 3a,$$

and the sums of the cubes of the cosines from the equation

$$4 \cos.^3 a = 3 \cos. a + \cos. 3a,$$

and thence deduce properties of the circle similar to those which we have found in § 361, and § 363.; but as the manner of proceeding, in the case of the cubes and higher powers, differs not at all from that which we have employed in finding the sum of their squares, we shall, for the sake of brevity, leave the powers which exceed the square to exercise the ingenuity of the reader.

365. The chords of arches possess properties in all respects analogous to those of their sines. For, from the nature of the chord of an arch,

$$\frac{1}{2} \text{ chord } a = \sin. \frac{1}{2} a, \text{ and } \frac{1}{2} \text{ chord supp. } a = \cos. \frac{1}{2} a.$$

Therefore, if in the various theorems which we have investigated, relating to the sines and cosines of arches, we substitute half the chord of the arch for the sine of half the arch, and half the chord of its supplement for its cosine, we shall have a new class of theorems relating to the chords of arches and the chords of their supplements.

366. For example, the 9th and 11th theorems, which may also be expressed thus,

$$\begin{aligned} 2 \sin. (n+1) \frac{1}{2} a &= 2 \cos. \frac{1}{2} a \times 2 \sin. n \frac{1}{2} a - 2 \sin. (n-1) \frac{1}{2} a \\ 2 \cos. (n+1) \frac{1}{2} a &= 2 \cos. \frac{1}{2} a \times 2 \cos. n \frac{1}{2} a - 2 \cos. (n-1) \frac{1}{2} a \end{aligned}$$

by making the proposed substitutions, are transformed to these other two theorems,

Also, observing that $\text{ch. sup. } 0 = \text{diam.} = 2$, we find from the second theorem that

$$\begin{aligned} \text{ch. sup. } a &= y \\ \text{ch. sup. } 2a &= y^2 - 2 \\ \text{ch. sup. } 3a &= y^3 - 3y \\ \text{ch. sup. } 4a &= y^4 - 4y^2 + 2 \\ \text{ch. sup. } 5a &= y^5 - 5y^3 + 5y \\ \text{ch. sup. } 6a &= y^6 - 6y^4 + 9y^2 - 2, \\ &\&c. \end{aligned}$$

If $4-x^2$, and the powers of that quantity be substituted for y^2 , and its powers, in the chords of $3a, 5a, 7a,$

Fig. 1.

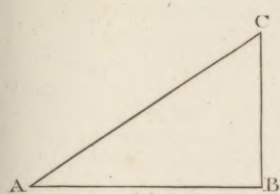


Fig. 2.

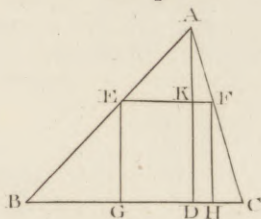


Fig. 3.

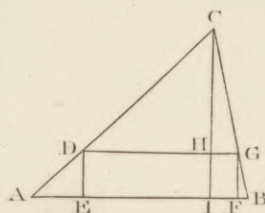


Fig. 4.

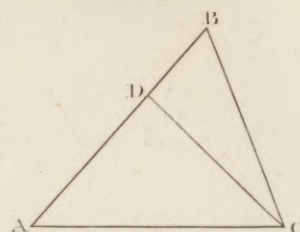


Fig. 5.

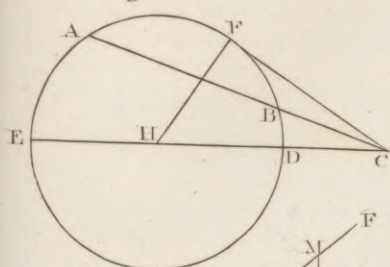


Fig. 6.

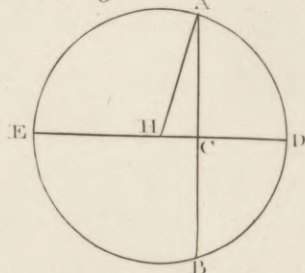


Fig. 7.

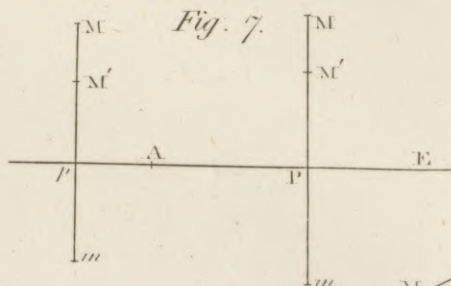


Fig. 8.

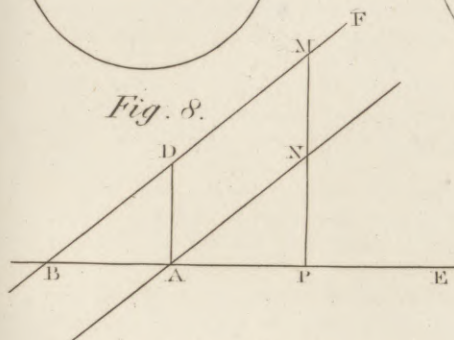


Fig. 9.

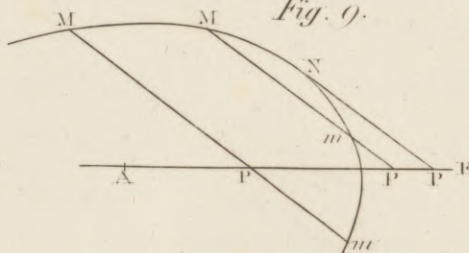


Fig. 10.

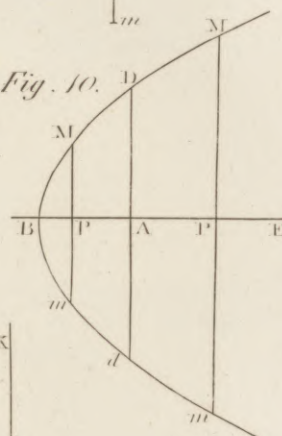


Fig. 11.

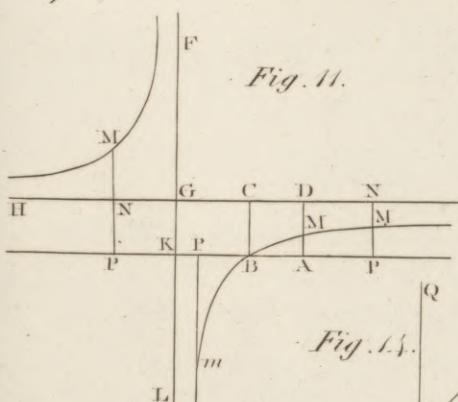


Fig. 12.

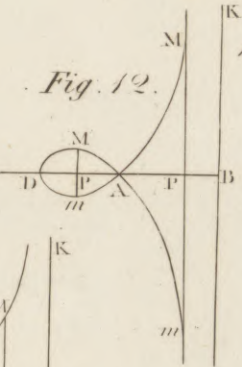


Fig. 13.

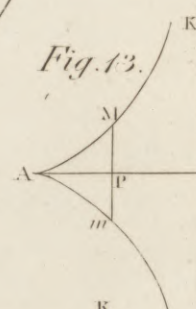


Fig. 15.

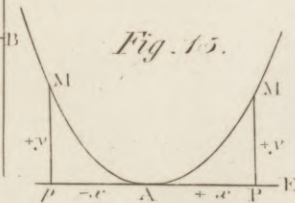


Fig. 14.

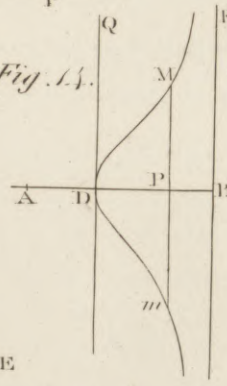


Fig. 16.

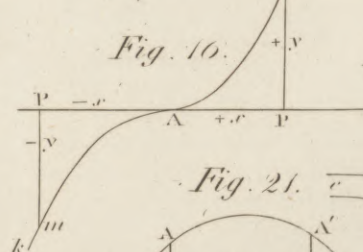


Fig. 17.

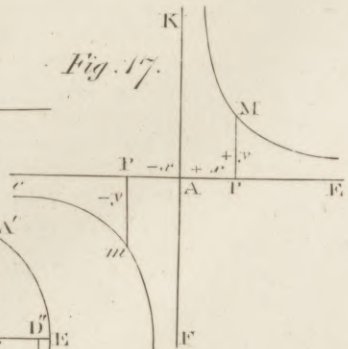


Fig. 18.

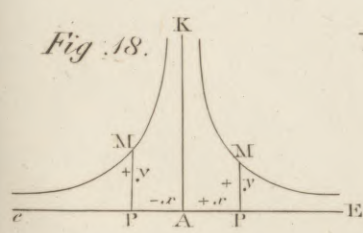


Fig. 19.

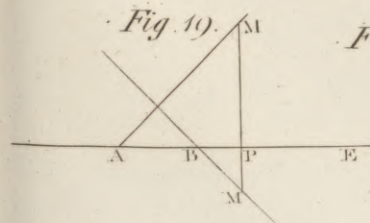


Fig. 20.

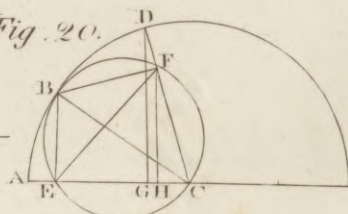
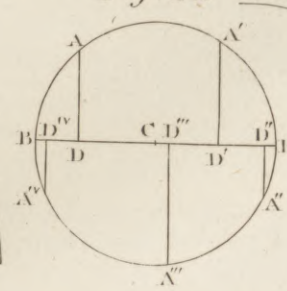


Fig. 21.



Arithmetic of Sines. 7a, &c. also in the chords of the supplements of 2a, 4a, 6a, &c. we shall obtain the following series of equations, expressing the relations between the chord of any arch, and the chords of the multiples of that arch, if those multiples be odd numbers, or the chords of their supplements, if they be even numbers.

$$\begin{aligned} \text{ch. } a &= +x \\ \text{ch. sup. } 2a &= -x^2 + 2 \\ \text{ch. } 3a &= -x^3 + 3x \\ \text{ch. sup. } 4a &= +x^4 - 4x^2 + 2 \\ \text{ch. } 5a &= +x^5 - 5x^3 + 5x \\ \text{ch. sup. } 6a &= -x^6 + 6x^4 - 9x^2 + 2 \\ \text{ch. } 7a &= -x^7 + 7x^5 - 14x^3 + 7x \\ &\&c. \end{aligned}$$

These equations are the foundation of the theory of angular sections, or method of dividing a given angle, or arch of a circle, into any proposed number of equal parts; a problem which evidently requires, for its general algebraic solution, the determination of the roots of an equation of a degree equal to the number of parts into which the arch is to be divided. By means of the same series of equations, we may also find the side of any regular polygon inscribed in a circle, and in this case the multiple arch, being equal to the whole circumference, will have its chord = 0.

368. The relation between the tangents of any two arches, and that of their sum, may be readily found by means of the 1st and 3d theorems of this section. For since $\sin. (a+b) = \sin. a \times \cos. b + \cos. a \times \sin. b$, and $\cos. (a+b) = \cos. a \times \cos. b - \sin. a \times \sin. b$; therefore, dividing the former equation by the latter,

$$\frac{\sin. (a+b)}{\cos. (a+b)} = \frac{\sin. a \times \cos. b + \cos. a \times \sin. b}{\cos. a \times \cos. b - \sin. a \times \sin. b}$$

this equation, by dividing each term in the numerator and denominator of the latter part of it by $\cos. a \times \cos. b$, may also be expressed thus:

$$\frac{\sin. (a+b)}{\cos. (a+b)} = \frac{\frac{\sin. a}{\cos. a} + \frac{\sin. b}{\cos. b}}{1 - \frac{\sin. a \times \sin. b}{\cos. a \times \cos. b}}$$

But the sine of any arch divided by its cosine is equal to the tangent of that arch, hence the last equation becomes

$$\text{Theor. XIII. } \tan. (a+b) = \frac{\tan. a + \tan. b}{1 - \tan. a \times \tan. b},$$

and by supposing the arch b negative, we also find

$$\text{Theor. XIV. } \tan. (a-b) = \frac{\tan. a - \tan. b}{1 + \tan. a \times \tan. b}.$$

369. From the first of these two theorems a series of equations may be derived expressing the relations which take place between the tangent of an arch and the tangent of any multiple of that arch. Thus, by assuming $b=a$, 2a, &c. and putting t for $\tan. a$,

$$\begin{aligned} \tan. 2a &= \frac{2t}{1-t^2} \\ \tan. 3a &= \frac{3t-t^3}{1-3t^2} \\ &\&c. \end{aligned}$$

and hence the tangent of an arch being given, the tangent of any part of that arch, as its half, third, &c. may be found by the resolution of an equation.

A L G

ALGEDO, a suppressed gonorrhœa, a name which occurs in old authors. See GONORRHOEA, MEDICINE *Index*.

ALGENEB, a fixed star of the second magnitude, in Perseus's right side. Its longitude is $27^\circ 46' 12''$ of Taurus, and its latitude $30^\circ 50' 28''$ north, according to Mr Flamstead's catalogue.

ALGEZIRA, a town of Andalusia in Spain, with a port on the coast of the straits of Gibraltar. By this city the Moors entered Spain in 713; and it was taken from them in 1344, after a very long siege, remarkable for being the first in which cannon were made use of. It was called *Old Gibraltar*, and is about four leagues from the New. W. Long. 5. 20. N. Lat. 36. 5.

ALGHIER, or **ALGERI**, a town in Sardinia, with a bishop's see, upon the western coast of the island, between Sasserri and Bosa. Though it is not large, it is well peopled, and has a commodious port. The coral fished for on this coast is in the highest esteem of any in the Mediterranean. E. Long. 8. 20. N. Lat. 40. 30.

ALGIABARII, a Mahometan sect of predestinarians, who attribute all the actions of men, good or evil, to the agency or influence of God. The Algiabarii stand opposed to the ALKADARII. They hold absolute

A L G

decrees and physical promotion. For the justice of God in punishing the evil he has caused, they resolve it wholly into his absolute dominion over the creatures.

ALGIDUM, a town of Latium, in Italy, between Preneste and Alba, near the mountains. On the top of one of these mountains was erected a temple of Diana, to which Horace refers, lib. i. ode 21. "*Quæcunque aut gelido prominet Algido*," and lib. iii. ode 23. "*Quæ nivali pascitur Algido*," &c.

ALGIERS, a kingdom of Africa, now one of the states of Barbary.—According to the latest and best computations, it extends 490 miles in length from east to west; but is very unequal in breadth, some places being scarcely 40 miles broad, and others upward of 100. It lies between Long. 1. 30. W. and 8. E. and extends from Lat. 33. to 36. 40. N.—It is bounded on the north by the Mediterranean, on the east by the river Zaine, the ancient Tusca, which divides it from Tunis; on the west by the Mulvya, and the mountains of Trava, which separate it from Morocco; and on the south by the Sahara, Zaara, or Numidian desert.

The kingdom of Algiers is at present divided into three provinces or districts, viz. the eastern, western, the king-
dom.

Algiers.

and southern. The eastern or Levantine government, which is by far the most considerable of the three, and is also called *Beylick*, contains the towns of Bona, Constantina, Gigeri, Bujeyah, Stessa, Tebsi, Zamoura, Biscara, and Necanz, in all which the Turks have their garrisons; besides which, it includes the two ancient kingdoms of Cuco and Labez, though independent of the Algerine government, to whose forces their country is inaccessible; so that they still live under their own cheyks chosen by each of their adowars or hordes. To these we may add a French factory at Callo, under the direction of the company of the French Bastion.—The western government hath the towns of Oran, Tremecen, Mostagan, Tenez, and Secrelly with its castle and garrison.—The southern government hath neither town, village, nor even a house, all the inhabitants living in tents, which obliges the dey and his forces to be always encamped.

Inhabitants.

The inhabitants along the sea coasts are a mixture of different nations; but chiefly Moors and Morescos driven out of Catalonia, Arragon, and other parts of Spain. Here are also great numbers of Turks, who come from the Levant to seek their fortune; as well as multitudes of Jews and Christians taken at sea, who are brought hither to be sold for slaves. The Berebers are some of the most ancient inhabitants of the country; and are supposed to be descended from the ancient Sabeans, who came hither from Arabia Felix under the conduct of one of their princes. Others believe them to be some of the Canaanites driven out of Palestine by Joshua. These are dispersed all over Barbary, and divided into a multitude of tribes under their respective chiefs: most of them inhabit the mountainous parts; some range from place to place, and live in tents, or portable huts; others in scattered villages: they have nevertheless, kept themselves for the most part from intermixing with other nations. The Berebers are reckoned the richest of all, go better clothed, and carry on a much larger traffic of cattle, hides, wax, honey, iron, and other commodities. They have also some artificers in iron, and some manufacturers in the weaving branch.—The name of *Bereber* is supposed to have been originally given them on account of their being first settled in some desert place. Upon their increasing in process of time, they divided themselves into five tribes, probably on account of religious differences, called the *Zinhagians*, *Musamedins*, *Zeneti*, *Hoares*, and *Gomeres*; and these having produced 600 families, subdivided themselves into a great number of petty tribes.—To these we may add the *Zuowahs*, by European authors called *Azuagues*, or *Assagues*, who are likewise dispersed over most parts of Barbary and Numidia. Great numbers of these inhabit the mountainous parts of Cuco, Labez, &c. leading a wandering pastoral life. But the most numerous inhabitants are the Moors and Arabians. The former are very stout and warlike, and skilful horsemen; but so addicted to robbing, that one cannot safely travel along the country at a distance from the towns without a guard, or at least a marabout or saint for a safeguard. For as they look upon themselves to be the original proprietors of the country, and not only as dispossessed by the rest of the inhabitants, but reduced by them to the lowest state of poverty, they make no scruple to plunder all they meet by way of reprisal. The inhabitants in general have a pretty

fair complexion; they are robust and well proportioned. People of distinction wear their beard; they have rich clothes made of silk, embroidered with flowers of gold, and turbans enriched with jewels. The Turks, who compose the military force, have great privileges, pay no taxes, are never publicly punished, and rarely in private. The lowest soldier domineers over the most distinguished Moors at pleasure. If he finds them better mounted than himself, he exchanges horses without ceremony. The Turks alone have the privilege of carrying fire arms. Many good qualities, however, distinguish them in spite of this excess of despotism. They never game for money, not even for trifles; and they never profane the name of the Deity. They soon forget their private quarrels: and after the first paroxysm of resentment is over, it is infamy for a Turk to keep in remembrance the injuries he has received. In this respect certainly they are less barbarous than other nations that boast of their civilization. See MOORS.

The climate of Algiers is in most places so temperate, Climate that there is a constant verdure: the leaves of the and soil trees being neither parched up by heat in summer, nor nipped by the winter's cold. They begin to bud in February; in April the fruit appears in its full bigness, and is commonly ripe in May. The soil, however, is excessively various; some places being very hot, dry, and barren, on which account they are generally suffered to lie uncultivated by the inhabitants, who are very negligent. These barren places, especially such as lie on the southern side, and are at a great distance from the sea, harbour vast numbers of wild animals, as lions, tigers, buffaloes, wild boars, stags, porcupines, monkeys, ostriches, &c. On account of their barrenness, they have but few towns, and those thinly peopled; though some of them are so advantageously situated for trading with Bildulgerid and Negroland, as to drive a considerable traffic with them.

The most considerable rivers of Algiers are, (1.) the Rivers. Ziz, which runs across the province of Tremecen and the desert of Anguid, falling into the Mediterranean near the town of Tabecrita, where it has the name of *Sirut*. (2.) The Haregol, supposed the *Sign* of Ptolemy, comes down from the great Atlas, crosses the desert of Anguid, and falls into the sea about five leagues from Oran. (3.) The Mina, supposed the *Chylematis* of Ptolemy, a larger river, which runs through the plains of Bathala, and falls into the sea near the town of Arzew. This river hath lately received the name of *Cena*, who rebuilt the town of Barthallaw after it had been destroyed. (4.) The Shellif, Zilef, or Zilif, descending from the Mount Guanexeris, runs through some great deserts, the lake Titteri, the frontiers of Tremecen, and Tenez, falling into the sea a little above the city of Mostagan. (5.) The Celef, supposed to be the *Cartheia* of the ancients, falls into the sea about three leagues west of Algiers, after a short course of 18 or 20 leagues. (6.) The Hued-al-quivir, supposed to be the *Nalabata* or *Nasaba* of the ancients, and called by the Europeans *Zinganir*, runs down with a swift course through some high mountains of Cuco, and falls into the sea near Bujeyah. Whilst the city of Bujeyah was in the hands of the Christians, the mouth of this river was so choked up with sand, that no vessel could come up into it: but in

Algiers.

Harbour of Bujeyah cleared by accident.

Algiers. 1555, very soon after it was taken by the Moors, the great rains swelled it to such a degree, that all the sand and mud was carried off; so that galleys and other vessels have ever since entered it with ease, where they lie safe from storms, and all winds but that which blows from the north. (7.) Suf-Gemar, or Suf-Gimmar al Rumniel, supposed to be the *Ampsaga* of Ptolemy, hath its source in Mount Auras, on the confines of Atlas; thence runs through some barren plains, and the fruitful ones of Constantina, where its stream is greatly increased by some other rivers it receives; from thence running northward, along the ridges of some high mountains, it falls into the sea a little east of Gigeri. (8.) The Ladag or Ludeg, runs down from Mount Atlas through a part of Constantina, and falls into the sea a little eastward of Bona. (9.) Guadi, or Guadel Barbar, springs from the head of Orbus, or Urbs, in Tripoli, runs through Bujeyah, and falls into the sea near Tabarea.

The Algerine kingdom made formerly a considerable part of the Mauritania Tingitana (see MAURITANIA), which was reduced to a Roman province by Julius Cæsar, and from him also called *Mauritania Cæsariensis*.—In the general account of Africa, it has been noticed, that the Romans were driven out of that continent by the Vandals; these by Belisarius, the Greek emperor Justinian's general; and the Greeks in their turn by the Saracens. This last revolution happened about the middle of the seventh century; and the Arabs continued masters of the country, dividing into a great number of petty kingdoms or states, under chiefs of their own choosing, till the year 1051.

bu-Texte-
in subduces
e Arab
inccs. This year, one Abubeker-ben-Omar, or, as the Spanish authors call him, *Abu Texefien*, an Arab of the Zinhagian tribe, being provoked at the tyranny of those despots, gathered, by the help of his marabouts or saints, a most powerful army of malecontents, in the southern provinces of Numidia and Libya. His followers were nicknamed *Marabites* or *Morabites*; by the Spaniards *Almoravides*; probably from their being assembled principally by the saints who were also called *Morabites*. The caliph of Kayem's forces were at this time taken up with quelling other revolts in Syria, Mesopotamia, &c. and the Arabs in Spain engaged in the most bloody wars; so that Texefien having nothing to fear from them, had all the success he could wish against the Arabian cheyks or petty tyrants, whom he defeated in many battles, and at last drove them not only out of Numidia and Libya, but out of all the western parts, reducing the whole province of Tingitana under his dominion.

Texefien was succeeded by his son Yusef, or Joseph, a brave and warlike prince. In the beginning of his reign, he laid the foundation of the city of Morocco, which he designed to make the capital of his empire. While that city was building, he sent some of his marabouts ambassadors to Tremecen (now a province of Algiers), at that time inhabited by a powerful and insolent sect of Mahometans called *Zeneti*. The design of this embassy was to bring them back to what he called the *true faith*; but the *Zeneti*, despising his offers, assembled at Amaf, or Amfa, their capital, murdered the ambassadors, and invaded Joseph's dominions with an army of 50,000 men.

neti
stroyed. The king hearing of their infamous proceedings,

speedily mustered his army, and led it by long marches into their country, destroying all with fire and sword; while the *Zeneti*, instead of opposing his progress, retired as fast as possible towards Fez, in hopes of receiving assistance from thence. In this they were miserably deceived: the Fezzans marched out against them in a hostile manner, and coming up with the unhappy *Zeneti*, encumbered with their families and baggage, and ready to expire with hunger and weariness, they cut them all to pieces, except a small number who were mostly drowned in attempting to swim across a river, and some others who in their flight perished by falling from the high adjacent rocks. In the mean time Joseph reduced their country to a mere desert: which was, however, soon peopled by a numerous colony of Fezzans, who settled there under the protection of the reigning kings. In this war it is computed that near a million of the *Zeneti*, men, women, and children, lost their lives.

The restless and ambitious temper of Joseph did not let him remain long at peace. He quickly declared war against the Fezzans, reduced them to become his tributaries, and extended his conquests all along the Mediterranean. He next attacked some Arabian cheyks who had not yet submitted to his jurisdiction; and pursued them with such fury, that neither the Libyan deserts, nor ridges of the most craggy rocks, could shelter them from his arms. He attacked them in such of their retreats, castles, and fortresses, as were till then deemed impregnable; and at last subdued them, to the great grief of the other African nations, who were greatly annoyed by the ravages committed by his numerous forces.

Thus was founded the empire of the Morabites: which, however, was of no long duration: that race being in the 12th century driven out by Mohavedin, a marabout. This race of priests was expelled by Ab-Sharifs of dulac governor of Fez; and he, in the 13th century, stripped of his new conquests by the sharifs of *Hascen*, who, the descendants of those Arabian princes whom Abu-Textefien had formerly expelled.

The better to secure their new dominions, the sharifs divided them into several little kingdoms or provinces; and among the rest the present kingdom of Algiers was divided into four, namely, *Tremecen*, *Tenez*, *Algiers Proper*, and *Bujeyah*. The four first monarchs laid so good a foundation for a lasting balance of power between their little kingdoms, that they continued for some centuries in mutual peace and amity; but at length the king of Tremecen having ventured to violate some of their articles, Abul-Farez, king of Tenez, declared war against him, and obliged him to become his tributary. This king dying soon after, and having divided his kingdom among his three sons, new discords arose; which Spain taking advantage of, a powerful fleet and army was sent against Barbary, under the count of Navarre, in 1505. This com-
Algerines
in danger
from the
Spaniards... mander soon made himself master of the important cities of Oran, Bujeyah, and some others; which so alarmed the Algerines, that they put themselves under the protection of Selim Eutemi, a noble and warlike Arabian prince. He came to their assistance with a great number of his bravest subjects, bringing with him his wife Zaphira, and a son then about 12 years old. This, however, was not sufficient to prevent the Spaniards.

Algiers. niards from landing a number of forces near Algiers that same year, and obliging that metropolis to become tributary to Spain. Nor could Prince Selim hinder them from building a strong fort on a small island opposite to the city, which terrified their corsairs from sailing either in or out of the harbour.

Invite Bar
barossa. To this galling yoke the Algerines were obliged to submit till the year 1516; when, hearing of the death of Ferdinand king of Spain, they sent an embassy to *Aruch Barbarossa*, who was at this time no less dreaded for his valour than his surprising success, and was then sent on a cruise with a squadron of galleys and barks. The purport of the embassy was, that he should come and free them from the Spanish yoke; for which they agreed to pay him a gratuity answerable to so great a service. Upon this *Barbarossa* immediately despatched 18 galleys and 30 barks to the assistance of the Algerines: while he himself advanced towards the city with 800 Turks, 3000 Jigelites, and 2000 Moorish volunteers. Instead of taking the nearest road to Algiers, he directed his course towards *Sharshel*, where *Hassan*, another famed corsair, had settled himself. Him he surprised, and obliged to surrender; not without a previous promise of friendship: but no sooner had *Barbarossa* got him in his power, than he cut off his head; and obliged all *Hassan's* Turks to follow him in his new expedition.

His treach-
ery and
cruelty. On *Barbarossa's* approach to Algiers, he was met by Prince *Eutemi*, attended by all the people of that metropolis, great and small; who looked for deliverance from this abandoned villain, whom they accounted invincible. He was conducted into the city amidst the acclamations of the people, and lodged in one of the noblest apartments of Prince *Eutemi's* palace, where he was treated with the greatest marks of distinction. Elated beyond measure with this kind reception, *Barbarossa* formed a design of becoming king of Algiers; and fearing some opposition from the inhabitants, on account of the excesses he suffered his soldiers to commit, murdered Prince *Eutemi*, and caused himself to be proclaimed king; his Turks and Moors crying out as he rode along the streets, "Long live King *Aruch Barbarossa*, the invincible king of Algiers, the *chosen of God* to deliver the people from the oppression of the Christians; and destruction to all that shall oppose, or refuse to own him for their lawful sovereign." These last threatening words so intimidated the inhabitants, already apprehensive of a general massacre, that he was immediately acknowledged king. The unhappy princess *Zaphira*, it is said, poisoned herself, to avoid the brutality of this new king, whom she unsuccessfully endeavoured to stab with a dagger.

Barbarossa was no sooner seated on the throne, than he treated his subjects with such cruelty, that they used to shut up their houses and hide themselves when he appeared in public. In consequence of this, a plot was soon formed against him; but being discovered, he caused twenty of the principal conspirators to be beheaded, their bodies to be buried in a dunghill, and laid a heavy fine on those who survived. This so terrified the Algerines, that they never afterwards durst attempt any thing against either *Barbarossa* or his successors.

In the mean time, the son of Prince *Eutemi* having

fled to Oran, and put himself under the protection of the marquis of Gomarez, laid before that nobleman a plan for putting the city of Algiers into the hands of the king of Spain. Upon this, young *Selim Eutemi* was sent to Spain, to lay his plan before Cardinal *Ximenes*; who having approved of it, sent a fleet with 10,000 land forces, under the command of *Don Francisco*, or, as others call him, *Don Diego de Vera*, to drive out the Turks, and restore the young prince. But the fleet was no sooner come within sight of land, than it was dispersed by a storm, and the greatest part of the ships dashed against the rocks. Most of the Spaniards were drowned; and the few who escaped to shore were either killed by the Turks or made slaves.

Though *Barbarossa* had nothing to boast on this occasion, his pride and insolence were now swelled to such a degree, that he imagined himself invincible, and that the very elements conspired to make him so. The Arabians were so much alarmed at his success, that they implored the assistance of *Hamid el Abdes* king of Tenez, to drive the Turks out of Algiers. That prince readily undertook to do what was in his power for this purpose, provided they agreed to settle the kingdom on himself and his descendants. This proposal being accepted, he immediately set out at the head of 10,000 Moors; and, upon his entering the Algerine dominions, was joined by all the Arabians in the country. *Barbarossa* engaged him, with only 1000 Turkish musqueteers and 500 Granada Moors; totally defeated his numerous army; pursued him to the very gates of his capital, which he easily made himself master of; and having given it up to be plundered by the Turks, obliged the inhabitants to acknowledge him as their sovereign. This victory, however, was chiefly owing to the advantage which his troops had from their fire-arms; the enemy having no other weapons than arrows and javelins.

No sooner was *Barbarossa* become master of the kingdom of Tenez, than he received an embassy from the inhabitants of Tremecen; inviting him to come to their assistance against their then reigning prince, with whom they were dissatisfied on account of his having dethroned his nephew, and forced him to fly to Oran; offering him even the sovereignty, in case he accepted of their proposal. The king of Tremecen, not suspecting the treachery of his subjects, met the tyrant with an army of 6000 horse and 3000 foot: but *Barbarossa's* artillery gave him such an advantage, that the king was at length forced to retire into the capital; which he had no sooner entered, than his head was cut off, and sent to *Barbarossa*, with a fresh invitation to come and take possession of the kingdom. On his approach, he was met with by the inhabitants, whom he received with complaisance, and many fair promises; but beginning to tyrannize as usual, his new subjects soon convinced him that they were not so passive as the inhabitants of Algiers. Apprehending, therefore, that his reign might prove uneasy and precarious, he entered into an alliance with the king of Fez; after which, he took care to secure the rest of the cities in his new kingdom, by garrisoning them with his own troops. Some of these, however, revolted soon after; upon which he sent one of his corsairs, named *Escander*, a man no less cruel than himself, to reduce them. The Tremecenians now began to re-

pent

Algiers. pent in good earnest of their having invited such a tyrant to their assistance ; and held consultations on the most proper means of driving him away, and bringing back their lawful prince *Abuchen Men* ; but their cabals being discovered, a great number of the conspirators were massacred in the most cruel manner. The prince had the good luck to escape to Oran, and was taken under the protection of the marquis of Gomarez, who sent immediate advice of it to Charles V. then lately arrived in Spain, with a powerful fleet and army. That monarch immediately ordered the young king a succour of 10,000 men, under the command of the governor of Oran ; who, under the guidance of *Abuchen Men*, began his march towards Tremecen ; and in their way they were joined by Prince *Selim*, with a great number of Arabs and Moors. The first thing they resolved upon was, to attack the important fortress of *Calau*, situated between Tremecen and Algiers, and commanded by the corsair *Escander* at the head of about 300 Turks. They invested it closely on all sides, in hopes *Barbarossa* would come out of Tremecen to its relief, which would give the Tremecenians an opportunity of keeping him out. That tyrant, however, kept close in his capital, being embarrassed by his fears of a revolt, and the politic delays of the king of Fez, who had not sent the auxiliaries he promised. The garrison of *Calau*, in the mean time, made a brave defence ; and, in a sally they made at night, cut off near 300 Spaniards. This encouraged them to venture a second time ; but they were now repulsed with great loss, and *Escander* himself wounded : soon after which, they surrendered upon honourable terms ; but were all massacred by the Arabians, except 16, who clung close to the stirrups of the king and of the Spanish general.

Barbarossa being now informed that *Abuchen Men*, with his Arabs, accompanied by the Spaniards, were in full march to lay siege to Tremecen, thought proper to come out, at the head of 1500 Turks and 5000 Moorish horse, in order to break his way through the enemy ; but he had not proceeded far from the city, before his council advised him to return and fortify himself in it. This advice was now too late ; the inhabitants being resolved to keep him out, and open their gates to their own lawful prince as soon as he appeared. In this distress *Barbarossa* saw no way left but to retire to the citadel, and there to defend himself till he could find an opportunity of stealing out with his men and all his treasure. Here he defended himself vigorously ; but his provisions failing him, he took advantage of a subterraneous back way, which he had caused to be digged up for that purpose ; and, taking his immense treasure with him, stole away as secretly as he could. His flight, however, was soon discovered ; and he was so closely pursued, that to amuse, as he hoped, the enemy, he caused a great deal of his money, plate, jewels, &c. to be scattered all the way, thinking they would not fail to stop their pursuit to gather it up. This stratagem, however, failed, through the vigilance of the Spanish commander, who being himself at the head of the pursuers, obliged them to march on, till he was come up close to him on the banks of the *Huexda*, about eight leagues from Tremecen. *Barbarossa* had just crossed the river, with his vanguard, when the Spaniards came up with his rear on the other side, and cut

them all off ; and then crossing the water, overtook him at a small distance from it. Here a bloody engagement ensued, in which the Turks fought like as many lions ; but, being at length overpowered by numbers, they were all cut to pieces, and *Barbarossa* among the rest, in the 44th year of his age, and four years after he had raised himself to the royal title of *Jigel* and the adjacent country, two years after he had acquired the sovereignty of Algiers, and scarcely a twelvemonth after the reduction of Tremecen. His head was carried to Tremecen on the point of a spear ; and *Abuchen Men* proclaimed king, to the joy of all the inhabitants. A few days after the fight, the king of Fez made his appearance at the head of 20,000 horse, near the field of battle ; but hearing of *Barbarossa's* defeat and death, marched off with all possible speed, to avoid being attacked by the enemy.

The news of *Barbarossa's* death spread the utmost consternation among the Turks at Algiers : however, they caused his brother *Hayradin* to be immediately proclaimed king. The Spanish commander now sent back the emperor's forces, without making any attempt upon Algiers ; by which he lost the opportunity of driving the Turks out of that country ; while *Hayradin*, justly dreading the consequences of the tyranny of his officers, sought the protection of the Grand Signior. This was readily granted, and himself appointed bashaw or viceroys of Algiers ; by which means he received such considerable reinforcements, that the unhappy Algerines durst not make the least complaint ; and such numbers of Turks resorted to him, that he was not only capable of keeping the Moors and Arabs in subjection at home, but of annoying the Christians at sea. His first step was to take the Spanish fort above mentioned, which was a great nuisance to his metropolis. The Spaniards held out to the last extremity ; but being all slain or wounded, *Hayradin* easily became master of the place.

Hayradin next set about building a strong mole for the safety of his ships. In this he employed 30,000 Christian slaves, whom he obliged to work without intermission for three years ; in which time the work was completed. He then caused the fort he had taken from the Spaniards to be repaired, and placed a strong garrison in it, to prevent any foreign vessels from entering the harbour without giving an account of themselves. By these two important works, *Hayradin* soon became dreaded not only by the Arabs and Moors, but also by the maritime Christian powers, especially the Spaniards. The viceroy failed not to acquaint the Grand Signior with his success, and obtained from him a fresh supply of money, by which he was enabled to build a stronger fort, and to erect batteries on all places that might favour the landing of an enemy. All these have since received greater improvements from time to time, as often as there was occasion for them.

In the mean time the sultan, either out of a sense of the great services *Hayradin* had done, or perhaps out of jealousy lest he should make himself independent, raised *Hayradin* to the dignity of bashaw of the empire, and appointed *Hassan Aga*, a Sardinian renegade, an intrepid warrior, and an experienced officer, to succeed him as bashaw of Algiers. *Hassan* had no sooner taken possession of his new government, than he began to pursue his ravages on the Spanish coast with greater

Algiers.
Barbarossa
defeated
and killed
by the Spaniards.

Succeeded
by Hayradin.

He takes
the Spanish
fort.

Succeeded
by Hassan
Aga.

Algiers.
Charles V's
expedition
against Al-
giers.

greater fury than ever; extending them to the ecclesiastical state, and other parts of Italy. But Pope Paul III. being alarmed at this, exhorted the emperor Charles V. to send a powerful fleet to suppress those frequent and cruel piracies; and that nothing might be wanting to render the enterprise successful, a bull was published by his holiness, wherein a plenary absolution of sins, and the crown of martyrdom, were promised to all those who either fell in battle or were made slaves; the emperor on his part needed no spur; and therefore set sail at the head of a powerful fleet, consisting of 120 ships and 20 galleys, having on board 30,000 chosen troops, and an immense quantity of money, arms, ammunition, &c. In this expedition many young nobility and gentry attended as volunteers, and among these many knights of Malta, so remarkable for their valour against the enemies of Christianity. Even ladies of birth and character attended Charles in his expedition, and the wives and daughters of the officers and soldiers followed them with a design to settle in Barbary after the conquest was finished. All these meeting with a favourable wind, soon appeared before Algiers; every ship displaying the Spanish colours on the stern, and another at the head, with a crucifix to serve them for a pilot.

Algiers in
great con-
sternation.

By this prodigious armament, the Algerines were thrown into the utmost consternation. The city was surrounded only by a wall with scarce any outworks. The whole garrison consisted of 800 Turks and 6000 Moors, without fire-arms, and poorly disciplined and accoutred; the rest of their forces being dispersed in the other provinces of the kingdom, to levy the usual tribute on the Arabs and Moors. The Spaniards landed without opposition, and immediately built a fort, under the cannon of which they encamped, and diverted the course of a spring which supplied the city with water. Being now reduced to the utmost distress, Hassan received a summons to surrender at discretion, on pain of being put to the sword with all the garrison. The herald was ordered to extol the vast power of the emperor both by sea and land, and to exhort him to return to the Christian religion. But to this Hassan only replied, that he must be a madman who would pretend to advise an enemy, and that the advised must still act more madly who would take counsel of such an adviser. He was, however, on the point of surrendering the city, when advice was brought him that the forces belonging to the western government were in full march towards the place. Upon which it was resolved to defend it to the utmost. Charles, in the mean time, resolving upon a general assault, kept a constant firing upon the town; which, from the weak defence made by the garrison, he looked upon as already in his hands. But while the *dewan*, or Algerine senate, were deliberating on the most proper means of obtaining an honourable capitulation, a mad prophet, attended by a multitude of people, entered the assembly, and foretold the speedy destruction of the Spaniards before the end of the moon, exhorting the inhabitants to hold out till that time. This prediction was soon accomplished in a very surprising and unexpected manner: for, on the 28th of October 1541, a dreadful storm of wind, rain, and hail, arose from the north, accompanied with violent shocks of earthquakes, and a dismal and universal darkness both by sea and land; so that the sun

Prevented
by a mad
prophet
from sur-
rendering.

moon, and elements, seemed to combine together for the destruction of the Spaniards. In that one night, some say in less than half an hour, 86 ships and 15 galleys were destroyed, with all their crews and military stores; by which the army on shore was deprived of all means of subsisting in these parts. Their camp also, which spread itself along the plain under the fort, was laid quite under water by the torrents which descended from the neighbouring hills. Many of the troops, by trying to remove into some better situation, were cut in pieces by the Moors and Arabs; while several galleys and other vessels, endeavouring to gain some neighbouring creeks along the coasts, were immediately plundered, and their crews massacred, by the inhabitants.

Algiers.
Spanish
fleet de-
stroyed by
a storm.

The next morning Charles beheld the sea covered with the fragments of so many ships, and the bodies of men, horses, and other creatures, swimming on the waves; at which he was so disheartened, that abandoning his tents, artillery, and all his heavy baggage, to the enemy, he marched at the head of his army, though in no small disorder, towards Cape *Malabux*, in order to reembark in those few vessels which had outweathered the storm. But Hassan, who had caused his motions to be watched, allowed him just time to get to the shore, when he sallied out and attacked the Spaniards in the midst of their hurry and confusion to get into their ships, killing great numbers, and bringing away a still greater number of captives; after which he returned in triumph to Algiers, where he celebrated with great rejoicings his happy deliverance from such distress and danger.

Soon after this, the prophet *Yusef*, who had foretold the destruction of the Spaniards, was not only declared the deliverer of his country, but had a considerable gratuity decreed him, with the liberty of exercising his prophetic function unmolested. It was not long, however, before the marabouts, and some interpreters of the law, made a strong opposition against him; remonstrating to the bashaw, how ridiculous and scandalous it was to their nation, to ascribe the deliverance of it to a poor fortune-teller, which had been obtained by the fervent prayers of an eminent saint of their own profession. But though the bashaw and his *dowan* seemed, out of policy, to give into this last notion, yet the impression which *Yusef's* predictions and their late accomplishment had made upon the minds of the common people, proved too strong to be eradicated; and the spirit of divination and conjuring has since got into such credit among them, that not only their great statesmen, but their priests, marabouts, and santouns, have applied themselves to that study, and dignified it with the name of *Mahomet's Revelations*.

The mad
prophet
rewarded.

The unhappy Spaniards had scarcely reached their ships, when they were attacked by a fresh storm, in which several more of them perished; one ship in particular, containing 700 soldiers, besides sailors, sunk in the emperor's sight, without a possibility of saving a single man. At length, with much labour, they reached the port of *Bujeyah*, at that time possessed by the Spaniards, whither Hassan king of Tunis soon after repaired with a supply of provisions for the emperor, who received him graciously, with fresh assurances of his favour and protection. Here he dismissed the few remains of the Maltese knights and their forces, who embarked in three shattered galleys, and with much difficulty

Fresh en-
sues of
the Spa-
niards.

Algiers. ficulty and danger reached their own country. Charles himself staid no longer than till the 16th of November, when he set sail for Carthage, and reached it on the 25th of the same month. In this unfortunate expedition upwards of 120 ships and galleys were lost, above 300 colonels and other land and sea officers, 8000 soldiers and marines, besides those destroyed by the enemy on the reembarkation, or drowned in the last storm. The number of prisoners was so great, that the Algerines sold some of them, by way of contempt, for an onion per head.

Hassan reduces Tremecen. Hassan, elated with this victory, in which he had very little share, undertook an expedition against the king of Tremecen, who, being now deprived of the assistance of the Spaniards, was forced to procure a peace, by paying a vast sum of money, and becoming tributary to him. The bashaw returned to Algiers, laden with riches; and soon after died of a fever, in the 66th year of his age.

Bujeyah taken from the Spaniards. From this time the Spaniards were never able to annoy the Algerines in any considerable degree. In 1555, they lost the city of Bujeyah, which was taken by Salha Rais, Hassan's successor; who next year set out on a new expedition, which he kept a secret, but was suspected to be intended against Oran; but he was scarcely got four leagues from Algiers, when the plague, which at that time raged violently in the city, broke out in his groin, and carried him off in 24 hours.

Hassan Corso chosen bashaw by the janizaries. Immediately after his death the Algerine soldiery chose a Corsican renegade, Hassan Corso, in his room, till they should receive farther orders from the Porte. He did not accept of the bashawship without a good deal of difficulty; but immediately prosecuted the intended expedition against Oran, despatching a messenger to acquaint the Porte with what had happened. They had hardly begun their hostilities against the place, when orders came from the Porte, expressly forbidding Hassan Corso to begin the siege, or, if he had begun it, enjoining him to raise it immediately. This news was received with great grief by the whole fleet and army, as they thought themselves sure of success, the garrison being at that time very weak. Nevertheless, as they dared not disobey, the siege was immediately raised.

Superseded by Tekelli, who puts him to a cruel death. Corso had hardly enjoyed his dignity four months, before news came, that eight galleys were bringing a new bashaw to succeed him; one *Tekelli*, a principal Turk of the Grand Signior's court: upon which the Algerines unanimously resolved not to admit him. By the treachery of the Levantine soldiers, however, he was admitted at last, and the unfortunate Corso thrown over a wall in which a number of iron hooks were fixed; one of which catching the ribs of his right side, he hung three days in the most exquisite torture before he expired.

Tekelli had no sooner entered upon his new government, than he behaved with such cruelty and rapaciousness, that he was assassinated even under the dome of a saint, by Yusef Calabres, the favourite renegade of Hassan Corso: who for this service was unanimously chosen bashaw, but died of the plague six days after his election.

Hassan re-instated. Yusef was succeeded by Hassan the son of Hayradin, who had been formerly recalled from his bashawship, when he was succeeded by Salha Rais; and now had the good fortune to get himself reinstated in his

employment. Immediately on his arrival, he engaged in a war with the Arabs, by whom he was defeated with great loss. The next year, the Spaniards undertook an expedition against Mostagan, under the command of the count d'Alcandela; but were utterly defeated, the commander himself killed, and 12,000 men taken prisoners. This disaster was owing to the inconsiderate rashness, or rather madness, of the commander; which was so great, that, after finding it impossible to rally his scattered forces, he rushed sword in hand into the thickest of the enemy's ranks, at the head of a small number of men, crying out, "St Jago! St Jago! the victory is ours, the enemy is defeated;" soon after which he was thrown from his horse, and trampled to death.

Hassan sent in irons to Constantinople. Hassan having had the misfortune to disoblige his subjects, by allowing the mountaineers of Cuco to buy ammunition at Algiers, was sent in irons to Constantinople, while the aga of the janizaries, and general of the land forces, supplied his place. Hassan easily found means to clear himself; but a new bashaw was appointed, called Achmet; who had no sooner arrived than he sent the two deputy bashaws to Constantinople, where their heads were struck off.—Achmet was a man of such insatiable avarice, that, upon his arrival at Algiers, all ranks of people came in shoals to make him presents; which he the more greedily accepted, as he had bought his dignity with the money he had amassed while head gardener to the Sultan. He enjoyed it, however, only four months; and after his death, the state was governed other four months by his lieutenant: when Hassan was a third time sent viceroy to Algiers, Reinstated. where he was received with the greatest demonstrations of joy.

The first enterprise in which Hassan engaged, was Siege of the siege of Marsalquiv, situated near the city Oran, Marsalquiv. which he designed to invest immediately after. The army employed in this siege consisted of 26,000 foot and 10,000 horse, besides which he had a fleet consisting of 32 galleys and galliots, together with three French vessels laden with biscuit, oil, and other provisions. The city was defended by Don Martin de Cordova, brother of the count d'Alcandela, who had been taken prisoner in the battle where that nobleman was killed, but had obtained his liberty from the Algerines with immense sums, and now made a most gallant defence against the Turks. The city was attacked with the utmost fury by sea and land, so that several breaches were made in the walls. The Turkish standards were several times planted on the walls, and as often dislodged; but the place must have in the end submitted, had not Hassan been obliged to raise the siege in haste, on the news that the famed Genoese admiral Doria was approaching with considerable succours from Italy. The fleet accordingly arrived soon after; but missing the Algerine galleys, bore away for Pennon de Velez, where they were shamefully repulsed by a handful of Turks who garrisoned that place; which, however, was taken the following year.

In 1567, Hassan was again recalled to Constantinople, where he died three years after. He was succeeded by Mahomet, who gained the love of the Algerines by several public-spirited actions. He incorporated the janizaries and Levantine Turks together, and by that means put an end to their dissensions, which

Algiers. laid the foundation of the Algerine independency on the Porte. He likewise added some considerable fortifications to the city and castle, which he designed to render impregnable. But while he was thus studying the interest of Algiers, one John Gascon, a bold Spanish adventurer, formed a design of surprising the whole piratic navy in the bay, and setting them on fire in the night-time, when they lay defenceless, and in their first sleep. For this he had not only the permission of King Philip II. but was furnished by him with proper vessels, mariners, and fireworks, for the execution of his plot. With these he set sail for Algiers in the most proper season, viz. the beginning of October, when most if not all the ships lay at anchor there, and easily sailed near enough, unsuspected, to view their manner of riding, in order to catch them unawares, at a time when the greater part of their crews were dispersed in their quarters. He came accordingly, unperceived by any, to the very mole-gate, and dispersed his men with their fire-works; but to their great surprise, they found them so ill mixed, that they could not with all their art make them take fire. In the mean time, Gascon took it into his head, by way of bravado, to go to the mole-gate, and give three loud knocks at it with the pommel of his dagger, and to leave it fixed in the gate by its point, that the Algerines might have cause to remember him. This he had the good fortune to do without meeting with any disturbance or opposition: but it was not so with his men; for no sooner did they find their endeavours unsuccessful, than they made such a bustle as quickly alarmed the guard posted on the adjacent bastion, from which the uproar quickly spread itself through the whole garrison. Gascon now finding himself in the utmost danger, sailed away with all possible haste: but he was pursued, overtaken, and brought back a prisoner to Mahomet: who no sooner got him into his power, than he immediately caused a gibbet of considerable height to be erected on the spot where Gascon had landed, ordering him to be hoisted up, and hung by the feet to a hook, that he might die in exquisite torture; and to show his resentment and contempt of the king his master, he ordered his commission to be tied to his toes. He had not, however, hung long in this state, when the captain who took him, accompanied by a number of other corsairs, interceded so strongly in his behalf, that he was taken down, and put under the care of some Christian surgeons; but two days after, some Moors reporting that it was the common talk and belief in Spain, that the Algerines durst not hurt a hair of Gascon's head, &c. the unfortunate Spaniard was hoisted up by a pulley to the top of the execution-wall, and let down again upon the hook, which in his fall caught him by the belly, and gave him such a wound, that he expired without a groan — Thus ended the expedition of John Gascon, which has procured him a place among the Spanish martyrs; while, on the other hand, the Algerines look upon his disappointment to have been miraculous, and owing to the efficacious protection of the powerful saint *Sidi Outededda*, whose prayers had before raised such a terrible storm against the Spanish fleet.

Mahomet, being soon after recalled, was succeeded by the famous renegado Ochali, who reduced the kingdom of Tunis; which, however, remained sub-

ject to the viceroy of Algiers only till the year 1586, when a bashaw of Tunis was appointed by the Porte. Algiers.

The kingdom of Algiers continued to be governed, till the beginning of the seventeenth century, by viceroys or bashaws appointed by the Porte; concerning whom we find nothing very remarkable, further than that their avarice and tyranny were intolerable both to the Algerines and the Turks themselves. At last the Turkish janizaries and militia becoming powerful enough to suppress the tyrannic sway of these bashaws, and the people being almost exhausted by the heavy taxes laid upon them, the former resolved to depose these petty tyrants, and set up some officer of their own at the head of the realm. The better to succeed in this attempt, the militia sent a deputation of some of their chief members to the Porte, to complain of the avarice and oppression of these bashaws, who sunk both the revenue of the state, and the money remitted to it from Constantinople, into their own coffers, which should have been employed in keeping up and paying the soldiery; by which means they were in continual danger of being overpowered by the Arabians and Moors, who, if ever so little assisted by any Christian power, would hardly fail of driving all the Turks out of the kingdom. They represented to the Grand Vizier how much more honourable as well as easier and cheaper, it would be for the Grand Signior to permit them to choose their own dey, or governor, from among themselves, whose interest it would then be to see that the revenue of the kingdom was rightly applied in keeping up its forces complete, and in supplying all other exigencies of the state, without any further charge or trouble to the Porte than that of allowing them its protection. On their part, they engaged always to acknowledge the Grand Signiors as their sovereigns, and to pay them their usual allegiance and tribute, to respect their bashaws, and even to lodge and maintain them and their retinue, in a manner suitable to their dignity, at their own charge. The bashaws, however, were, for the future, to be excluded from assisting at any but general douwans, unless invited to it; and from having the liberty of voting in them, unless when their advice was asked, or the interest of the Porte was likely to suffer by their silence. All other concerns, which related to the government of Algiers, were to be wholly left under the direction of the dey and his douwan.

These proposals having been accepted by the Porte, Algerines the deputies returned highly satisfied; and having notified their new privileges, the great *douwan* immediately proceeded to the election of a dey from among themselves. They compiled a new set of laws, and made several regulations for the better support and maintenance of this new form of government, to the observation of which they obliged all their subjects to swear; and the militia, navy, commerce, &c. were all settled pretty nearly on the footing upon which they now are, and which shall be afterwards described; though the subsequent altercations that frequently happened between the bashaws and deys, the one endeavouring to recover their former power, and the other to curtail it, caused such frequent complaints and discontents at the Ottoman court, as made them frequently repent their compliance.

In

Algiers.

In the year 1601, the Spaniards, under the command of Doria the Genoese admiral, made another attempt upon Algiers, in which they were more fortunate than usual, their fleet being only driven back by contrary winds, so that they came off without loss. In 1609, the Moors being expelled from Spain, flocked in great numbers to Algiers; and as many of them were very able sailors, they undoubtedly contributed to make the Algerine fleet so formidable as it became soon after; though it is probable the frequent attempts made on their city would also induce them to increase their fleet. In 1616, their fleet consisted of 40 sail of ships between 200 and 400 tons, their admiral 500 tons. It was divided into two squadrons, one of 18 sail, before the port of Malaga; and the other at the cape of Santa Maria, between Lisbon and Seville; both of which attacked all Christian ships, both English and French, with whom they pretended to be in friendship, as well as Spaniards and Portuguese, with whom they were at war.

Become
formidable
to the Eu-
ropeans.

The Algerines were now become very formidable to the European powers. The Spaniards, who were most in danger, and least able to cope with them, solicited the assistance of England, the pope, and other states. The French, however, were the first who dared to show their resentment of the perfidious behaviour of these miscreants; and in 1617, M. Beaulieu was sent against them with a fleet of 50 men of war, who defeated their fleet, took two of their vessels, while their admiral sunk his own ship and crew, rather than fall into his enemies hands.

An English
squadron
sent against
the Alge-
rines.

In 1620, a squadron of English men of war was sent against Algiers, under the conduct of Sir Robert Mansel; but of this expedition we have no other account than that it returned without doing any thing; and the Algerines, becoming more and more insolent, openly defied all the European powers, the Dutch only excepted; to whom, in 1625, they sent a proposal directed to the prince of Orange, that in case they would fit out 20 sail of ships the following year, upon any good service against the Spaniards, they would join them with 60 sail of their own.

The next year, the *Coulolies*, or *Cologlies* (the children of such Turks as had been permitted to marry at Algiers), who were enrolled in the militia, having seized on the citadel, had well nigh made themselves masters of the city; but were attacked by the Turks and renegadoes, who defeated them with terrible slaughter. Many of them were put to death; and their heads thrown in heaps upon the city walls, without the eastern gate. Part of the citadel was blown up; and the remaining *Coulolies* were dismissed from the militia, to which they were not again admitted till long after.

States of
Barbary
throw off
their depen-
dence on
the Porte.

In 1623, the Algerines and other states of Barbary threw off their dependence on the Porte altogether, and set up for themselves. What gave occasion to this was the 25 years truce which Sultan Amurath IV. was obliged to make with the emperor Ferdinand II. to prevent his being overmatched by carrying on a war against him and the sophi of Persia at the same time. As this put a stop to the piratical trade of the Algerines, they proceeded as above mentioned, and resolved, that whoever desired to be at peace with them, must, distinctly and separately, apply to their government.—

Algiers.

No sooner was this resolution taken, than the Algerines began to make prizes of several merchant ships belonging to powers at peace with the Porte. Nay, having seized a Dutch ship and poleacre at Scanderoon, they ventured on shore; and finding the town abandoned by the Turkish aga and inhabitants, they plundered all the magazines and warehouses, and set them on fire.—About this time Louis XIII. undertook to build a fort on their coasts, instead of one formerly built by the Marsilians, and which they had demolished. This, after some difficulty, he accomplished; and it was called the *Bastion of France*: but the situation being afterwards found inconvenient, the French purchased the port of La Calle, and obtained liberty to trade with the Arabians and Moors. The Ottoman court, in the mean time, was so much embarrassed with the Persian war, that there was no leisure to check the Algerine piracies. This gave an opportunity to the vizier and other courtiers to compound matters with the Algerines, and to get a share of their prizes, which were very considerable. However, for form's sake, a severe reprimand, accompanied with threats, was sent them; to which they replied, "that these depredations deserved to be indulged to them, seeing they were the only bulwark against the Christian powers, especially against the Spaniards, the sworn enemies of the Moslem name; adding, that "if they should pay a punctilious regard to all that could purchase peace, or liberty to trade with the Ottoman empire, they would have nothing to do but set fire to all their shipping, and turn camel-drivers for a livelihood."

In the year 1635, four younger brothers of a good family in France entered into an undertaking so desperate, that perhaps the annals of knight-errantry can scarcely furnish its equal.—This was no less than to retort the piracies of the Algerines upon themselves; and as they indiscriminately took the ships of all nations, so were these heroes indiscriminately to take the ships belonging to Algiers; and this with a small frigate of ten guns!—In this ridiculous undertaking, 100 volunteers embarked; a Maltese commission was procured, together with an able master, and 36 mariners.—They had the good fortune, on their first setting out, to take a ship laden with wine, on the Spanish coast: with which they were so much elated, that three days after they madly encountered two large Algerine corsairs, one of 20 and the other of 24 guns, both well manned, and commanded by able officers. These two large vessels having got the small frigate between them, plied her furiously with great shot, and soon took off her mainmast: notwithstanding which, the French made so desperate a resistance, that the pirases were not able to take them, till the noise of their fire brought up five more Algerines; when the French vessel, being almost torn to pieces, was boarded and taken. The young knight-errants were punished for their temerity by a dreadful captivity, from which they redeemed themselves in 1642 at the price of 6000 dollars.

Desperate
undertaking
of four
younger
brothers.

The Algerines prosecuted their piracies with impunity, to the terror and disgrace of the Europeans, till the year 1652; when a French fleet being accidentally driven to Algiers, the admiral took it into his head to demand a release of all the captives of his nation, without exception. This being refused, the Frenchman without ceremony carried off the Turkish vice-

A French
admiral
carries off
the Turkish
bashaw.

Algiers.

roy, and his cadí or judge, who had just arrived from the Porte, with all their equipage and retinue. The Algerines, by way of reprisal, surprised the Bastion of France already mentioned, and carried off the inhabitants to the number of 600, with all their effects; which so provoked the admiral, that he sent them word that he would pay them another visit the next year with his whole fleet.

The Algerines fit out a formidable fleet.

The Algerines, undismayed by the threats of the French admiral, fitted out a fleet of 16 galleys and galliots, excellently manned and equipped, under the command of Admiral Hali Pinchinin.—The chief design of this armament was against the treasure of Loretto; which, however, they were prevented by contrary winds from obtaining. On this they made a descent on Puglia in the kingdom of Naples; where they ravaged the whole territory of Necotra, carrying off a vast number of captives, and among them some nuns. From thence steering towards Dalmatia, they scoured the Adriatic; and loading themselves with immense plunder, left those coasts in the utmost consternation and resentment.

which is totally destroyed by the Venetians.

At last the Venetians, alarmed at such terrible depredations, equipped a fleet of 28 sail, under the command of Admiral Capello, with express orders to burn, sink, or take, all the Barbary corsairs he met with, either on the open seas, or even in the Grand Signior's harbours, pursuant to a late treaty of peace with the Porte. On the other hand, the captain bashaw, who had been sent out with the Turkish fleet to chase the Florentines and Maltese cruisers out of the Archipelago, understanding that the Algerine squadron was so near, sent express orders to the admiral to come to his assistance. Pinchinin readily agreed; but having first resolved on a descent upon the island of Lissa, or Lisina, belonging to the Venetians, he was overtaken by Capello, from whom he retired to Valona, a sea port belonging to the Grand Signior, whither the Venetian admiral pursued him; but the Turkish government refusing to eject the pirates according to the articles of the peace between the Ottoman court and Venice, Capello was obliged to content himself with watching them for some time. Pinchinin was soon weary of restraint, and ventured out; when an engagement immediately ensued, in which the Algerines were defeated, and five of their vessels disabled, with the loss of 1300 men, Turks, and Christian slaves; besides 1600 galley slaves who regained their liberty. Pinchinin, after this defeat, returned to Valona, where he was again watched by Capello; but the latter had not long lain at his old anchorage before he received a letter from the senate, desiring him to make no farther attempt on the pirates at that time, for fear of a rupture with the Porte. This was followed by a letter from the governor of Valona, desiring him to take care lest he incurred the sultan's displeasure by such insults. The brave Venetian was forced to comply; but resolving to take such a leave of the Algerines as he thought they deserved, observed how they had reared their tents, and drawn their booty and equipage along the shore. He then kept firing among their tents, while some well manned galliots and brigantines were ordered among their shipping, who attacked them with such bravery, that, without any great loss, they rowed out their 16 galleys, with all their cannon, stores, &c.—In this last engagement

Algiers. a ball from one of the Venetian galleys happening to strike a Turkish mosque, the whole action was considered as an insult upon the Grand Signior. To conceal this, Capello was ordered to sink all the Algerine ships he had taken, except the admiral; which was to be conducted to Venice, and laid up as a trophy. Capello came off with a severe reprimand; but the Venetians were obliged to buy, with 500,000 ducats, a peace from the Porte. The Grand Signior offered to repair the loss of the Algerines by building ten galleys for them, upon condition that they should continue in his service till the end of the ensuing summer; but Pinchinin, who knew how little the Algerines chose to lie under obligations to him, civilly declined the offer.

In the mean time, the news of this defeat and loss filled Algiers with the utmost grief and confusion. The whole city was on the point of a general insurrection, when the bashaw and douwan issued a proclamation, forbidding not only complaints and outcries, under the severest penalties; but all persons whatever to *take their thumbs from within their girdles*, while they were deliberating upon this important point. In the mean time they applied to the Porte for an order that the Venetians settled in the Levant should make up their loss. But with this the Grand Signior refused to comply, and left them to repair their losses, as well as build new ships in the best manner they could. It was not long, however, before they had the satisfaction to see one of their corsairs land, with a fresh supply of 600 slaves, whom he had brought from the coast of Iceland, whither he had been directed by a miscreant native taken on board a Danish ship.

Our pirates did not long continue in their weak and defenceless state; being able at the end of two years, to appear at sea with a fleet of 65 sail. The admiral Pinchinin equipped four galliots at his own expence: with which, in conjunction with the chiahah, or secretary of the bashaw of Tripoli, he made a second excursion. This small squadron, consisting of five galleys and two brigantines, fell in with an English ship of 40 guns; which, however, Pinchinin's captains refused to engage; but being afterwards reproached by him for their cowardice, they swore to attack the next Christian ship which came in their way. This happened to be a Dutch merchantman, of 28 guns, which was deeply laden, and unable to use her sails by reason of a calm. Pinchinin immediately summoned her to surrender; but receiving an ironical answer, drew up his squadron in form of a half moon, that they might pour all their shot at once into their adversary. This, however, the Dutchman avoided, by means of a breeze of wind which fortunately sprung up and enabled him to turn his ship; upon which the galleys ran foul of each other. Upon this, Pinchinin ran his own galley along side of the merchantman, the upper deck of which 70 Algerines immediately took possession of, some of them cutting the rigging, and others plying the hatches with hand grenades: but the Dutchmen having secured themselves in their close quarters, began to fire at the Algerines on board, from two pieces of cannon loaded with small shot; by which they were all soon killed, or forced to submit. Pinchinin, in the mean time, made several unsuccessful attempts to relieve his men, as well as to surround the Dutchman with his other galleys; but that ship lay so deep in the water,

Algiers.

Algiers in the utmost confusion at the news.

They set out a new fleet.

Five of their galleys defeated a Dutch merchantman.

Algiers. water, that every shot did terrible execution among the pirates; so that they were obliged to remove farther off. At last the Dutch captain, having ordered his guns to be loaded with cartouches, gave them such a parting volley as killed 200 of them, and sent the rest back to Algiers in a most dismal plight.

**Prepara-
tions a-
gainst Al-
giers by
Louis XIV.**

But though Pinchinin thus returned in disgrace, the rest of the fleet quickly came back with vast numbers of slaves, and an immense quantity of rich spoils; inso-much that the English, French, and Dutch, were obliged to cringe to the mighty Algerines, who sometimes vouchsafed to be at peace with them, but swore eternal war against Spain, Portugal, and Italy, whom they looked upon as the greatest enemies to the Mahometan name. At last Louis XIV. provoked by the grievous outrages committed by the Algerines on the coast of Provence and Languedoc, ordered, in 1681, a considerable fleet to be fitted out against them, under the marquis du Quesne, vice-admiral of France. His first expedition was against a number of Tripolitan corsairs; who had the good fortune to outrow him, and shelter themselves in the island of Scio belonging to the Turks. This did not, however, prevent him from pursuing them thither, and making such terrible fire upon them as quickly destroyed 14 of their vessels, besides battering the walls of the castle.

**Algiers
bombarded
and set on
fire by the
French.**

This severity seemed only to be designed as a check to the piracies of the Algerines; but, finding they still continued their outrages on the French coast, he sailed to Algiers in August 1682, cannonading and bombarding it so furiously, that the whole town was in flames in a very little time. The great mosque was battered down, and most of the houses laid in ruins, inso-much that the inhabitants were on the point of abandoning the place; when on a sudden the wind turned about, and obliged Du Quesne to return to Toulon. The Algerines immediately made reprisals, by sending a number of galleys and galliots to the coast of Provence, where they committed the most dreadful ravages, and brought away a vast number of captives: upon which a new armament was ordered to be got ready at Toulon and Marseilles against the next year; and the Algerines, having received timely notice, put themselves into as good a state of defence as the time would allow.

**The city
again bom-
barded.**

In May 1683, Du Quesne with his squadron cast anchor before Algiers; where, being joined by the Marquis d'Affranville at the head of five stout vessels, it was resolved to bombard the town next day. Accordingly 100 bombs were thrown into it the first day, which did terrible execution; while the besieged made some hundred discharges of their cannon against them without doing any considerable damage. The following nights the bombs were again thrown into the city in such numbers, that the dey's palace and other great edifices were almost destroyed; some of their batteries were dismounted, and several vessels sunk in the port. The dey and Turkish bashaw, as well as the whole soldiery, alarmed at this dreadful havock, immediately sued for peace. As a preliminary, the immediate surrender was insisted on of all Christian captives who had been taken fighting under the French flag; which being granted, 142 of them were immediately delivered up, with a promise of sending him the remainder as soon as they could be got from the different parts of the country. Accordingly Du Quesne

sent his commissary-general and one of his engineers into the town; but with express orders to insist upon the delivery of all the French captives without exception, together with the effects they had taken from the French: and that Mezomorto their then admiral, and Hali Rais one of their captains, should be given as hostages.

Algiers.

This last demand having embarrassed the dey, he assembled the douwan, and acquainted them with it; upon which Mezomorto fell into a violent passion, and told the assembly that the cowardice of those who sat at the helm had occasioned the ruin of Algiers: but that, for his part, he would never consent to deliver up any thing that had been taken from the French. He immediately acquainted the soldiery with what had passed; which so exasperated them, that they murdered the dey that very night, and on the morrow chose Mezomorto in his place. This was no sooner done, than he cancelled all the articles of peace which had been made, and hostilities were renewed with greater fury than ever.

The French admiral now kept pouring in such vol-
leys of bombs, that in less than three days the greatest
part of the city was reduced to ashes; and the fire
burnt with such vehemence, that the sea was enlight-
ened with it for more than two leagues round. Mezo-
morto, unmoved at all these disasters, and the vast num-
ber of the slain, whose blood ran in rivulets along the
street; or rather, growing furious and desperate, sought
only how to wreak his revenge on the enemy; and, not
content with causing all the French in the city to be
cruelly murdered, ordered their consul to be tied hand
and foot, and fastened alive to the mouth of a mortar,
from whence he was shot away against their navy.—By
this piece of inhumanity Du Quesne was so exaspera-
ted, that he did not leave Algiers till he had utterly
destroyed all their fortifications, shipping, almost all
the lower part, and above two-thirds of the upper part
of the city, by which means it became little else than
a heap of ruins.

**Set on fire,
and almost
destroyed.**

The haughty Algerines were now thoroughly con-
vinced that they were not invincible; and therefore sue for
immediately sent an embassy into France, begging in
the most abject terms for peace; which Louis imme-
diately granted, to their inexpressible joy. They now
began to pay some regard to other nations, and to be
a little cautious how they wantonly incurred their dis-
pleasure. The first bombardment by the French had
so far humbled the Algerines, that they condescended
to enter into a treaty with England; which was renewed
upon terms very advantageous to the latter in 1686.
It is not to be supposed, however, that the natural per-
fidy of the Algerines would disappear on a sudden: not-
withstanding this treaty, therefore, they lost no oppor-
tunity of making prizes of the English ships when they
could conveniently come at them. Upon some infringe-
ment of this kind, Captain Beach drove ashore and
burnt seven of their frigates in 1695; which produced
a renewal of the treaty five years after; but it was not
till the taking of Gibraltar and Port Mahon, that Bri-
tain could have a sufficient check upon them to enforce
the observation of treaties; and these have since proved
such restraints upon Algiers, that they still continue to
pay a greater deference to the English than to any other
European power.

**Seven of
their ships
burnt by
Captain
Beach.**

Algiers.
Expulsion
of the Turk-
ish bashaw.

The seventeenth century furnishes no very remarkable events with regard to Algiers, except the taking of the famed city of Oran from the Spaniards in 1708 (which however they regained in 1737), and the expulsion of the Turkish bashaw, and uniting his office to that of dey in 1710. This introduced the form of government which still continues in Algiers, but which made no change in their piratical spirit.

Britain at length had the glory of putting a period to an outrage, under which Europe had groaned for several centuries. As soon as the termination of the continental war allowed leisure to attend to this object, a squadron was sent to Algiers under Lord Exmouth, who was instructed to require, that all the European captives in the Algerine territory should be delivered up, on the payment of a stipulated ransom; and that this nefarious system should be for ever relinquished. The Algerines, under the dread inspired by the presence of the British fleet, concluded a treaty upon these terms; but scarcely was Lord Exmouth departed, when it was violated in the most shocking manner, by the massacre of a large body of Neapolitan fishermen at Bona. This intelligence reached England almost immediately after the arrival of Lord Exmouth, who speedily set sail with an augmented force, to avenge this atrocious violation of the law of nations. The dey, sensible that force only could now avert the threatened punishment, made every possible preparation for defence. The attack by the fleet was one of the most daring to be found in our naval records. On the 27th August 1816, the ships took their places in front of a most formidable range of double batteries, within a very short distance. The resistance was obstinate, but unavailing. The batteries were destroyed, the Algerine fleet in the harbour reduced to ashes, and the dey was compelled to submit to the humiliating terms imposed,—the restoration of all his present captives without ransom, with the repayment of ransoms formerly received, and the abolition for ever of Christian slavery. This great achievement was not accomplished without the loss of 600 or 700 men killed or wounded in the British fleet. It is likely, however, that the severe lesson taught the Algerines, will put an end to their depredations.

Revenues,
&c. of the
dey.

The dey is now absolute monarch; and pays no other revenue to the Porte than that of a certain number of fine boys or youths, and some other presents, which are sent thither yearly. His own income probably rises and falls according to the opportunities he has of fleecing both natives and foreigners; whence it is variously computed by different authors. Dr Shaw computes the taxes of the whole kingdom to bring into the treasury no more than 300,000 dollars; but supposes that the eighth part of the prizes, the effects of those persons who die without children, joined to the yearly contributions raised by the government, presents from foreigners, fines and oppressions, may bring in about as much more. Both the dey and officers under him enrich themselves by the same laudable methods of rapine and fraud; which it is no wonder to find the common people practising upon one another, and especially upon strangers, seeing they themselves are impoverished by heavy taxes and the injustice of those who are in authority.

We have already hinted, that the first deys were

elected by the militia, who were then called the *douwan* or common council. This elective body was at first composed of 800 militia officers, without whose consent the dey could do nothing; and upon some urgent occasions all the officers residing in Algiers, amounting to above 1500, were summoned to assist. But since the deys, who may be compared to the Dutch stadtholders, have become more powerful, the *douwan* is principally composed of 30 *chiahs* bashaws or colonels, with now and then the *mufti* and *cadi* upon some emergencies; and, on the election of a dey, the whole soldiery are allowed to come and give their votes.

In this country it is not to be expected that justice will be administered with any degree of impartiality. The Mahometan soldiery, in particular, are so much favoured, that they are seldom put to death for any crime except rebellion: in which case they are either strangled with a bow string or hanged to an iron hook. In lesser offences, they are fined, or their pay stopped; and if officers, they are reduced to the station of common soldiers, from whence they may gradually raise themselves to their former dignity. Women guilty of adultery, have a halter tied about their necks, with the other end fastened to a pole, by which they are held under water till they are suffocated. The *bastinado* is likewise inflicted for small offences; and is given either upon the belly, back, or soles of the feet, according to the pleasure of the *cadi*; who also appoints the number of strokes. These sometimes amount to 200 or 300, according to the indulgence the offender can obtain either by bribery or friends; and hence he often dies under this punishment for want of powerful enough advocates. But the most terrible punishments are those inflicted upon the Jews or Christians who speak against Mahomet or his religion; in which case, they must either turn Mahometans or be impaled alive. If they afterwards apostatize, they are burned or roasted alive, or else thrown down from the top of the city walls upon iron hooks, where they are caught by different parts of their body according as they happen to fall, and sometimes expire in the greatest torments; though by accident they may be put out of pain at once, as we have already related of the Spanish adventurer John Gascon.

The officer next in power to the dey is the *aga* of the janizaries, who is one of the eldest officers in the janizaries army, and holds his post only for two months. He is then succeeded by the *chiah*, or next senior officer. During the two months in which the *aga* enjoys his dignity, the keys of the metropolis are in his hands; all military orders are issued out in his name; and the sentence of the dey upon any offending soldier, whether capital or not, can only be executed in the court of his palace.—As soon as he has gone through this short office, he is considered as *mazoul*, or superannuated; receives his pay regularly, like the rest of the militia, every two moons; is exempt from all further duties, except when called by the dey to assist at the grand council, to which he hath, however, a right to come at all times, but hath no longer a vote in it. Next to the *aga* in dignity is the secretary of state, who registers all the public acts; and after him are the 30 *chiahs* or colonels, who sit next to the *aga* in the *douwan*, and in the same gallery with him. Out of this class are generally chosen those who go ambassadors to foreign

Algiers.

Punish-
ments, &c.

Aga of the
janizaries
and other
military of-
ficers.

reign

Algiers.

reign courts, or who disperse the dey's orders throughout the realm. Next to them are 800 bolluck bashaws or eldest captains, who are promoted to that of chiah bashaws according to their seniority. The oldack bashaws or lieutenants are next; who amount to 400, and are regularly raised to the rank of captains in their turn, and to other employments in the state, according to their abilities. These, by way of distinction, wear a leather strap, hanging down to the middle of their back. One rule is strictly observed in the rotation of these troops from one degree to a higher, viz. the right of seniority; one single infringement of which would cause an insurrection, and probably cost the dey his life. Other military officers of note are the vekelards or purveyors of the army; the beys, who are the four oldest soldiers, and consequently the nearest to preferment; the soulacks, who are the next in seniority to them, and are part of the dey's body-guard, always marching before him when he takes the field, and distinguished by their carabines and gilt scimitars, with a brass gun on their caps; the kayts or Turkish soldiers, each band of whom has the government of one or more adowars or itinerant villages, and collects their taxes for the dey; and the sagiards or Turkish lance-men, 100 of whom always attend the army, and watch over the water appointed for it. To these we may add the beys or governors of the three great provinces of the realm. All the above-mentioned officers ought to compose the great douwan or council above mentioned; but only the 30 chiah bashaws have a right to sit in the gallery next after the dey; the rest are obliged to stand on the floor of the hall or council chamber, with their arms across, and as much as possible without motion; neither are they permitted to enter with their swords on, for fear of a tumult. As for those who have any matter to transact with the douwan, they must stand without, let the weather be ever so bad; and there they are commonly presented with coffee by some of the inferior officers, till they are dismissed.

account of
the corsairs,
commerce,
&c.

It does not appear that the Algerines avail themselves of the benefit of their internal resources to the extent they might do; for their genius leads them too much to the piratical trade to mind any real advantage that might be derived from their own country. The corsairs or pirates form each a small republic, of which the rais or captain is the supreme bashaw; who, with the officers under him, form a kind of douwan, in which every matter relating to the vessel is decided in an arbitrary way. These corsairs are chiefly instrumental in importing whatever commodities are brought into the kingdom either by way of merchandise or prizes. These consist chiefly of gold and silver stuffs, damasks, cloths, spices, tin, iron, plated brass, lead, quicksilver, cordage, sail-cloth, bullets, cochineal, linen, tartar, alum, rice, sugar, soap, cotton raw and spun, copperas, aloes, brazil and logwood, vermilion, &c. Very few commodities, however, are exported from this part of the world: the oil, wax, hides, pulse, and corn produced, being but barely sufficient to supply the country; though, before the loss of Oran, the merchants have been known to ship off from one or other of the ports of Barbary several thousand tons of corn. The consumption of oil, though here in great abundance, is likewise so considerable in

Algiers.

this kingdom, that it is seldom permitted to be shipped off for Europe. The other exports consist chiefly in ostriches feathers, copper, rugs, silk sashes, embroidered handkerchiefs, dates, and Christian slaves. Some manufactures in silk, cotton, wool, leather, &c. are carried on in this country, but mostly by the Spaniards settled here, especially about the metropolis. Carpets are also a manufacture of the country; which, though much inferior to those of Turkey both in beauty and fineness, are preferred by the people to lie upon, on account of their being both cheaper and softer. There are also at Algiers looms for velvets, taffetas, and other wrought silks; and a coarse sort of linen is likewise made in most parts of the kingdom. The country furnishes no materials for ship building. They have neither ropes, tar, sails, anchors, nor even iron. When they can procure enough of new wood to form the main timbers of a ship, they supply the rest from the materials of prizes which they have made; and thus find the secret of producing new and swift-sailing vessels from the ruins of the old. Of all the states on the coast of Barbary, the Algerines are the strongest at sea.

The religion of the Algerines is chiefly distinguished from that of the Turks by a greater variety of superstitious rites. The Koran is their acknowledged rule of faith and practice; but they are not very scrupulous in the observance of it. The musti, or high priest; the cadi, or chief judge; and the grand marabout, are the three principal officers who preside in matters of religion. The cadi attends in the court of justice once or twice every day, to hear and determine causes; but those of superior importance are submitted to the dey himself, or, in his absence, to one of the principal officers of the regency, who sits in the gate of the palace for that express purpose. Of this custom some traces are found in sacred history, Deut. xx. 11. 15. xxv. 7.

ALGIERS, a city, the capital of the above kingdom, is probably the ancient *Icosium*: by the Arabians called *Algezair*, or rather *Al-Jezier*, or *Al-Jezerah*, i. e. *the island*, because there was an island before the city, to which it has since been joined by a mole. It is built on the declivity of a hill by the sea-side, in the form of an amphitheatre: at sea, it looks like the top-sail of a ship. The tops of the houses are quite flat and white, and have all the appearance of a bleachfield. One house rises above another in such a manner that they do not hinder each other's prospect. The streets are so narrow, that they will scarcely admit two persons to walk abreast, and the middle part is lower than the sides. When any loaded beasts, such as camels, horses, mules, or asses, pass along, you are forced to stand up close to the wall to let them pass by. There is but one broad street, which runs through the city from east to west, in which are the shops of the principal merchants, and the market for corn and other commodities. The lower part of the walls of the city is of hewn stone, and the upper part of brick; they are 30 feet high on the land side, and 40 towards the sea; the fosses or ditches are 20 feet wide, and 7 deep. There is no sweet water in the city; and though there is a tank or cistern in every house, yet they often want water, because it rains but seldom: the chief supply is from a spring on a hill, the water of which is conveyed

Algiers,
Algoa.

conveyed by pipes to above a hundred fountains, at which a bowl is fastened for the use of passengers. The common reservoir is at the end of the mole, where the ships take in their water. Every one takes his turn at these places, except the Turks, who are first, and the Jews last. There are five gates, which are open from sunrise till sun-setting; and seven forts or castles without the walls, the greatest of which is on the mole without the gate, all of which are well supplied with great guns. There are 10 large mosques and 50 small ones; three great colleges or public schools, and a great number of petty ones for children. The houses are square, and built of stone and brick, with a square court in the middle, and galleries all around. There are said to be about 100,000 inhabitants in the city, comprehending 5000 Jewish families, besides Christians. There are four fundics or public inns such as are in Turkey; and six cazernes, or barracks, for the unmarried Turkish soldiers, which will hold 600 each. There are no inns for Christians to lodge at; but only a few tippling huts kept by slaves, for the accommodation of Greeks and the poorer sort of travellers, where any thing may be had for money. Here are bagnios or public baths, in the same manner as in Turkey, at a very moderate rate. The women have baths of their own, where the men dare not come. Without the city there is a great number of sepulchres, as also cells or chapels, dedicated to marabouts or reputed saints, which the women visit every Friday. The Turkish soldiers are great tyrants; for they not only turn others out of the way in the streets, but will go to the farm-houses in the country for 20 days together, living at free quarters, and making use of every thing, not excepting the women. The Algerines eat, as in Turkey, sitting cross-legged round a table about four inches high, and use neither knives nor forks. Before they begin, every one says *Be isme Allah*, "In the name of God." When they have done, a slave pours water on all their hands as they sit, and then they wash their mouths. Their drink is water, sherbet, and coffee. Wine is not allowed, though drank immoderately by some. The prospect of the country and sea from Algiers is very beautiful, it being built on the declivity of a mountain; but the city, though for several ages it has braved some of the greatest powers in Christendom, it is said, could make but a faint defence against a regular siege; and that three English fifty-gun ships might batter it about the ears of its inhabitants from the harbour. If so, the Spaniards must have been very deficient either in courage or conduct. They attacked it in the year 1775, by land and by sea, but were repulsed with great loss; though they had near 20,000 foot and 2000 horse, and 47 king's ships of different rates and 346 transports. In the years 1783 and 1784, they are also renewed their attacks by sea to destroy the city and galleys; but after spending a quantity of ammunition, bombs, &c. were forced to retire without either its capture or extinction. The mole of the harbour is 500 paces in length, extending from the continent to a small island where there is a castle and large battery. E. Long. 3. 30. N. Lat. 36. 42.

ALGOA BAY, or *Zwart-hops*, in southern Africa, is situated in S. Lat. 33. 56. E. Long. 26. 53. and 500 miles distant from the Cape of Good Hope. Mr Barrow, who visited this place, found, in an adjoin-

ing valley, a species of antelope called the *riet-bok*, or red-goat, previously unknown to naturalists. He also mentions that great advantages might accrue to the East India Company from the erection of an establishment at this place, for the purpose of preparing salted beef and fish, in consequence of the salt-pans, and the abundance of large bullocks, in the vicinity; together with great numbers of excellent fish, with which the coast abounds.

ALGOL, a fixed star of the third magnitude, called *Medusa's Head*, in the constellation Perseus. Its longitude is 21° 50' 42" of Taurus, and its latitude 23° 23' 47" north; according to Flamstead's catalogue. For an account of its changes, period, and other circumstances, see *ASTRONOMY Index*.

ALGONQUINS, a nation in North America, who formerly possessed great tracts of land along the north shore of the river St Lawrence. For a long time they had no rivals as hunters and warriors, and were long in alliance with the Iroquois; whom they agreed to protect from all invaders, and to let them have a share of their venison. The Iroquois, on the other hand, were to pay a tribute to their allies, out of the culture of the earth; and to perform for them all the menial duties, such as flaying the game, curing the flesh, and dressing the skins. By degrees, however, the Iroquois associated in the hunting matches and warlike expeditions of the Algonquins; so that they soon began to fancy themselves as well qualified, either for war or hunting, as their neighbours. One winter a large detachment of both nations having gone out a hunting, and secured, as they thought, a vast quantity of game, six young Algonquins and as many Iroquois were sent out to begin the slaughter. The Algonquins, probably become a little jealous of their associates, upon seeing a few elks, desired the Iroquois to return, on pretence that they would have sufficient employment in flaying the game they should kill; but after three days hunting, having killed none, the Iroquois exulted, and in a day or two privately set out to hunt for themselves. The Algonquins were so exasperated at seeing their rivals return laden with game, that they murdered all the hunters in the night time. The Iroquois dissembled their resentment: but in order to be revenged, applied themselves to study the art of war as practised among those savage nations. Being afraid of engaging with the Algonquins, at first they tried their prowess on other inferior nations, and, when they thought themselves sufficiently expert, attacked the Algonquins with such diabolical fury, as showed they could be satisfied with nothing less than the extermination of the whole race; which, had it not been for the interposition of the French they would have accomplished.—The few Algonquin nations, that are now to be seen, seem entirely ignorant of agriculture, and subsist by fishing and hunting. They allow themselves a plurality of wives; notwithstanding which, they daily decrease in populousness, few or none of their nations containing above 6000 souls, and many of them not 2000. Their language is one of the three radical ones in North America, being understood from the river St Lawrence to the Mississippi.

ALGOR, with physicians, an unusual coldness in any part of the body.

ALGORITHM, an Arabic word expressive of numerical computation.

Algoa
Algorithm.

ALGUAZIL, in the *Spanish polity*, an officer whose business it is to see the decrees of a judge executed.

ALHAMA, a very pleasant town of the kingdom of Granada, in Spain, situated in the midst of some craggy mountains, about 25 miles S. W. of Granada, on the banks of the Rio Frio, in W. Long. 3. 26. N. Lat. 36. 59. and having the finest warm baths in all Spain. It was taken from the Moors in 1481. The inhabitants, though surprised, and the town without a garrison, made a gallant defence : but being at length forced to submit, the place was abandoned to the pillage of the Christian soldiers, who not satisfied with an immense quantity of gold and jewels, made slaves of upwards 3000 of the inhabitants.

ALHAMBRA, the ancient fortress and residence of the Moorish monarchs of Granada. It derives its name from the red colour of the materials which it was originally built with, Alhambra signifying a red house. It appears to a traveller a huge heap of as ugly buildings as can well be seen, all huddled together, seemingly without the least intention of forming *one* habitation out of them. The walls are entirely unornamented, all gravel and pebbles, daubed over with plaster by a very coarse hand : yet this is the palace of the Moorish kings of Granada, indisputably the most curious place within that exists in Spain, perhaps in the world. In many countries may be seen excellent modern as well as ancient architecture, both entire and in ruins ; but nothing to be met with anywhere else can convey an idea of this edifice, except the decorations of an opera, or the tales of the genii.

Passing round the corner of the emperor's palace, one is admitted at a plain unornamented door in a corner. On my first visit, says Mr Swinburne, I confess I was struck with amazement, as I stepped over the threshold, to find myself on a sudden transported into a species of fairy land. The first place you come to is the court called the *communa* or *del mesucar*, that is, the *common baths* ; an oblong square, with a deep bason of clear water in the middle ; two flights of marble steps leading down to the bottom ; on each side a parterre of flowers, and a row of orange trees. Round the court runs a peristyle paved with marble ; the arches bear upon very slight pillars, in proportions and style different from all the regular orders of architecture. The ceilings and walls are incrustated with fretwork in stucco, so minute and intricate, that the most patient draughtsman would find it difficult to follow it, unless he made himself master of the general plan. This would facilitate the operation exceedingly ; for all this work is frequently and regularly repeated at certain distances, and has been executed by means of square moulds applied successively, and the parts joined together with the utmost nicety. In every division are Arabic sentences of different lengths, most of them expressive of the following meanings : " There is no conqueror but God ; " or, " Obedience and honour to our lord Abouabdoulah." The ceilings are gilt or painted ; and time has caused no diminution in the freshness of their colours, though constantly exposed to the air. The lower part of the walls is mosaic, disposed in fantastic knots and festoons. A work so novel, so exquisitely finished, and so different from all that he had ever seen, must afford a stranger the most

agreeable sensations while he treads this magic ground. **Alhambra.** The porches at the ends are more like grotto-work than any thing else to which they can be compared. That on the right hand opens into an octagon vault, under the emperor's palace, and forms a perfect whispering gallery, meant to be a communication between the offices of both houses.

Opposite to the door of the *communa* through which you enter, is another leading into the *quarto de los leones*, or apartments of the lions ; which is an oblong court, 100 feet in length and 50 in breadth, environed with a colonnade seven feet broad on the sides and 10 at the end. Two porticoes or cabinets about 15 feet square, project into the court at the two extremities. The square is paved with coloured tiles ; the colonnade with white marble. The walls are covered five feet up from the ground with blue and yellow tiles, disposed chequerwise. Above and below is a border of small escutcheons, enamelled blue and gold, with an Arabic motto on a bend ; signifying, " No conqueror but God." The columns that support the roof and gallery are of white marble, very slender, and fantastically adorned. They are nine feet high, including base and capital, and eight inches and a half diameter. They are very irregularly placed ; sometimes singly, at others in groups of three, but more frequently two together. The width of the horse-shoe arches above them is four feet two inches for the large ones, and three for the smaller. The ceiling of the portico is finished in a much finer and more complicated manner than that of the *communa*, and the stucco laid on the walls with inimitable delicacy ; in the ceiling it is so artfully frosted and handled as to exceed belief. The capitals are of various designs, though each design is repeated several times in the circumference of the court, but not the least attention has been paid to placing them regularly or opposite to each other. Not the smallest representation of animal life can be discovered amidst the varieties of foliages, grotesques, and strange ornaments. About each arch is a large square of arabesques, surrounded with a rim of characters, that are generally quotations from the Koran. Over the pillars is another square of delightful filligree work. Higher up is a wooden rim, or kind of cornice, as much enriched with carving as the stucco that covers the part underneath. Over this projects a roof of red tiles, the only thing that disfigures this beautiful square. This ugly covering is a modern addition made by a late prime minister, who a few years ago gave the Alhambra a thorough repair. In Moorish times, the building was covered with large painted and glazed tiles, of which some few are still to be seen. In the centre of the court are twelve ill-made lions muzzled, their fore parts smooth, their hind parts rough, which bear upon their backs an enormous bason, out of which a lesser rises. While the pipes were kept in good order, a great volume of water was thrown up, that, falling down into the basons, passed through the beasts, and issued out of their mouths into a large reservoir, where it communicated by channels with the jets d'eau in the apartments. This fountain is of white marble, embellished with many festoons and Arabic distichs, thus translated :

" Seest thou not how the water flows copiously like the Nile ? "

Alhambra.

"This resembles a sea washing over its shores, threatening shipwreck to the mariner."

"This water runs abundantly, to give drink to the lions."

"Terrible as the lion is our king in the day of battle."

"The Nile gives glory to the king, and the lofty mountains proclaim it."

"This garden is fertile in delights: God takes care that no noxious animal shall approach it."

"The fair princess that walks in this garden, covered with pearls, augments its beauty so much, that thou may'st doubt whether it be a fountain that flows, or the tears of her admirers."

Passing along the colonnade, and keeping on the south side, you come to a circular room occupied by the men as a place for drinking coffee, &c. A fountain in the middle refreshed the apartment in summer. The form of this hall, the elegance of its cupola, the cheerful distribution of light from above, and the exquisite manner in which the stucco is designed, painted, and finished, exceed all power of description. Every thing in it inspires the most pleasing voluptuous ideas: yet in this sweet retreat they pretend that Abouabdoulah assembled the Abencerrages, and caused their heads to be struck off into the fountain. Continuing your walk round, you are next brought to a couple of rooms at the head of the court, which are supposed to have been tribunals or audience chambers.

Opposite to the *Sala de los Abencerrages* is the entrance into the *Torre de las dos hermanas*, or the tower of the two sisters; so named from two very beautiful pieces of marble laid as flags in the pavement. This gate exceeds all the rest in profusion of ornaments, and in beauty of prospect which it affords through a range of apartments, where a multitude of arches terminate in a large window open to the country. In a gleam of sunshine, the variety of tints and lights thrown upon this enfilade are uncommonly rich. The first hall is the concert room, where the women sat; the musicians played above in four balconies. In the middle is a jet d'eau. The marble pavement is equal to the finest existing, for the size of the flags and evenness of the colour. The two sisters, which give name to the room, are slabs that measure 15 feet by seven and a half, without flaw or stain. The walls, up to a certain height, are mosaic, and above are divided into very neat compartments of stucco, all of one design, which is also followed in many of the adjacent halls and galleries. The ceiling is a fretted cove. To preserve this vaulted roof, as well as some of the other principal cupolas, the outward walls of the towers are raised 10 feet above the top of the dome, and support another roof over all, by which means no danger can ever be caused by wet weather or excessive heat and cold. From this hall you pass round the little myrtle garden of Tindaraxa, into an additional building made to the east end by Charles V. The rooms are small and low. His dear motto, *Plus outre*, appears on every beam. This leads to a little tower, projecting from the line of the north wall, called *el tocador*, or the dressing-room of the sultana. It is a small square cabinet, in the middle of an open gallery, from which it receives light by a door and three windows. The look-out is charming. In one corner is a large marble flag, drilled full

Alhambra.

of holes, through which the smoke of perfumes ascended from furnaces below; and here, it is presumed, the Moorish queen was wont to sit to fumigate and sweeten her person. The emperor caused this pretty room to be painted with representations of his wars, and a great variety of grotesques, which appear to be copies, or at least imitations, of those in the loggie of the Vatican. From hence you go through a long passage to the hall of ambassadors, which is magnificently decorated with innumerable varieties of mosaics, and the mottoes of all the kings of Granada. This long narrow antichamber opens into the communia on the left hand, and on the right into the great audience hall in the tower of Comares; a noble apartment, 36 feet square, 36 high up to the cornice, and 18 from thence to the centre of the cupola. The walls on three sides are 15 feet thick, on the other nine; the lower range of windows 13 feet high. The whole wall is inlaid with mosaic of many colours, disposed in intricate knots, stars, and other figures. In every part various Arabic sentences are repeated.

Having thus completed the tour of the upper apartments, which are upon a level with the offices of the new palace, you descend to the lower floor, which consisted of bedchambers and summer-rooms; the back stairs and passages, that facilitated the intercourse between them, are without number. The most remarkable room below is the king's bedchamber, which communicated by means of a gallery with the upper story. The beds were placed in two alcoves, upon a raised pavement of blue and white tiles; but as it was repaired by Philip V. who passed some time here, it cannot be said how it may have been in former times. A fountain played in the middle, to refresh the apartment in hot weather. Behind the alcoves are small doors, that conduct you to the royal baths. These consist of one small closet with marble cisterns for washing children, two rooms for grown up persons, and vaults for boilers and furnaces that supplied the baths with water and the stoves with vapours. The troughs are formed of large slabs of white marble; the walls are beautiful with party-coloured earthen ware; light is admitted by holes in the coved ceiling.

Hard by is a whispering gallery, and a kind of labyrinth, said to have been made for the diversion of the women and children. One of the passages of communication is fenced off with a strong iron grate, and called *the prison of the Sultana*; but it seems more probable that it was put up to prevent any body from climbing up into the women's quarter.

Under the council-room is a long slip, called *the king's study*; and adjoining to it are several vaults said to be the place of burial of the royal family. In the year 1574, four sepulchres were opened; but as they contained nothing but bones and ashes, were immediately closed again.

This description of the Alhambra may be finished by observing how admirably every thing was planned and calculated for rendering this palace the most voluptuous of all retirements; what plentiful supplies of water were brought to refresh it in the hot months of summer; what a free circulation of air was contrived, by the judicious disposition of doors and windows; what shady gardens of aromatic trees; what noble views over the beautiful hills and fertile plains? No

wonder

Ali. wonder the Moors regretted Granada ! no wonder that they still offer up prayers to God every Friday for the recovery of this city, which they regard as a terrestrial paradise !

ALI, the son of Abu Taleb, is one of the most celebrated characters in Mahometan history. He was cousin to Mahomet ; and at the age of fourteen engaged with youthful ardour in his cause. When Mahomet first revealed his prophetic character to his friends, and inquired who among them would undertake to be his companion, Ali exclaimed, " O Prophet, I will be thy attendant ; the man who dares to rise against thee I will break his legs, pluck out his eyes, dash out his teeth, and even rip up his belly." Mahomet accepted his services, and honoured him with the titles of brother, vicegerent, and Aaron to a new Moses. He was remarkable both for eloquence and valour ; and the latter obtained him the surname of "*the Lion of God, always victorious.*" He succeeded to the chief dignity of the renowned house of Hashem, and was also hereditary guardian of the temple and city of Mecca. Mahomet gave him his daughter Fatimah in marriage, and the grandfather lived to embrace the children of his daughter. These advantages induced Ali to cast a wistful eye towards the regal succession ; however, Abubeker, Omar, and Othman, reigned before him. But after the death of the latter he was saluted caliph by the chiefs of the tribes, and companions of the Prophet, when he was repairing to the mosque of Medina at the hour of prayer, A. D. 655. Hegir. 35.

Ayesha, the widow of the Prophet, strenuously opposed his succession ; and under her influence two powerful chiefs soon raised the standard of rebellion. Ali greatly increased his difficulties by the imprudent removal of all the governors of provinces from their stations. Telha and Zobeir, two chiefs of great influence, collected a numerous army, and induced Ayesha to attend them to the field of battle ; but Ali gained a complete victory, and took Ayesha prisoner. Telha fell in the field, and Zobeir was assassinated after surrendering upon promise of quarter. This dastardly action was severely reprehended by Ali. He likewise kindly treated the captive widow, and sent her back to the tomb of the Prophet.

Ali next attacked Moawiyah, who had been proclaimed caliph, and strongly supported by a powerful and numerous party. When the two armies approached each other, Ali proposed to decide the matter by single combat, but to this his opponent would not agree. Several skirmishes were fought with considerable loss on both sides ; but at length a pious fraud produced a division of sentiment in the army of Ali. They fixed to the points of lances a number of copies of the Koran, carried them before the troops, and exclaimed, saying, " This is the book which forbids Mussulmans to shed each others blood, and ought therefore to decide our disputes." Ali was constrained to yield, and umpires were mutually chosen ; on the side of Ali, Abu Moussa ; Amru, the conqueror of Egypt on the part of Moawiyah. The day of final decision arrived. Abu Moussa ascended the pulpit, and cried, " As I draw this ring from my finger, so I depose both Ali and Moawiyah from the caliphate." When Amru ascended, he cried, " As I put on this ring, so

I invest Moawiyah with the caliphate, and also depose Ali." He also added, that Othman the former caliph had declared Moawiyah both his successor and avenger. Thus began that memorable contest among the Mahometans which was long agitated with considerable violence by both parties.

Ali was highly enraged at this injustice ; but constrained for the present to yield, he retired to Kufa. A sect of enthusiasts called the *Kharejites* revolted against Ali ; but he quickly reduced them to subjection, and again obtained possession of Arabia. But Syria, Persia and Egypt fell to the share of his rival.

An unexpected event terminated the existing disputes. Three Kharejites one day conversing together concerning the blood which had been shed, and the impending calamities, resolved to assassinate Ali, Moawiyah, and Amru, the three authors of the present disasters. They provided themselves with poisoned swords, and hastened to accomplish their purpose. Moawiyah was wounded, but the wound did not prove fatal. A friend of Amru fell in his stead. Ali was fatally wounded at the door of the mosque ; and in the sixty-third year of his age, he expired on the fifth day after his wound, A. D. 660. A. Hegir. 40.

Ali had eight wives besides Fatimah, and left a numerous family, who were very remarkable for their valour. He also rose to high eminence for learning and wisdom ; and of his works there are still extant a hundred maxims, a collection of verses, and a prophecy of all the great events which are to happen to the end of time. One of his sayings may be quoted as an example. " He who would be rich without wealth, powerful without subjects, and a subject without a master, has only to forsake sin, and serve God."

The Mussulmans term Ali *the heir of Mahomet, and the accepted of God*, and his particular followers have possessed various states in Africa and Asia, and the Persian part of the Usbec Tartars ; and some sovereigns of India are at present of the sect of Ali. A monument is raised upon his tomb near Kufa, which the kings of Persia have successively decorated and religiously revered. Near the ruins of Kufa a city named *Meshed Ali* has been built to his memory. Some of his deluded followers imagine that he is still alive, and that he will revisit the earth and fill the same with justice. A green turban still continues to distinguish the descendants of Ali. (*Gen. Biog.*)

ALI *Bey*, an eastern adventurer, is said to have been a native of Mount Caucasus, and about the age of twelve or fourteen he was sold for a slave in Cairo. The two Jews who became his masters presented him to Ibrahim, then one of the most respectable men in the kingdom. In the family of this powerful man he received the rudiments of literature, and was also instructed in the military art. Both in letters and military skill he made a rapid improvement. He gradually gained the affection of his patron to such a degree, that he gave him his freedom, permitted him to marry, promoted him to the rank of governor of a district, and afterwards by election he was raised to the elevated station of one of the governors of provinces. Deprived of his protector by death, and engaging in the dangerous intrigues that pave the way to power in that unstable government, he procured his own banishment to Upper Egypt. Here he spent two years in maturing

Ali. his schemes for future greatness, and in 1766, returning to Cairo, he either slew or expelled the beys, and seized the reins of government.

Emboldened by success, he rescued himself from the power of the Porte, coined money in his own name, and boldly assumed the rank of sultan of Egypt. Occupied in more important concerns, the Porte made no vigorous opposition to his measures, and Ali Bey seized this favourable opportunity to recover a part of the Said or Upper Egypt, which had been taken by an Arab shaik. Next he sent out a fleet from Suez, which seized upon Djedda, entered the port of Mecca; while a body of cavalry, commanded by Mohammed Bey his favourite, took and plundered Mecca itself. A young Venetian merchant laid before him a plan of reviving the ancient trade to the East Indies through the Mediterranean and Red seas. Having formed an alliance in 1770, with one Shaik Daher, a rebel against the Porte in Syria, he aimed at the conquest of all Syria and Palestine. He first endeavoured to secure Gaza; then his army forming a junction with that of Daher at a place called Acre, advanced to Damascus. On the 6th of June 1771, a battle was fought at this place with the Turkish pachas, and Mohammed and Daher the commanders of Ali Bey routed them with great slaughter. They instantly took possession of Damascus, and the castle itself had also capitulated, when all on a sudden Mohammed hastened back to Egypt with all his Mamelukes. Some ascribe this strange conduct to an impression made upon Mohammed by the Turkish agents, and others to a report of the death of Ali Bey.

Although unsuccessful, Ali Bey never lost sight of his favourite object, and Mohammed losing his confidence was forced to save his life by exile. Mohammed, however, quickly returned with an army, and drove Ali Bey from Cairo. In this unfortunate state of affairs Ali Bey fled to Daher, and combining their forces, they attacked the Turkish commander at Sidon, and came off victorious, although the Turkish army was three times their number. After a siege of eight months they next took the town of Jaffa. Deceived by letters from Cairo which were only intended to ensnare him, and stimulated with recent victories, he returned to Cairo. Entering the deserts which divide Gaza from Egypt, he was furiously attacked by a thousand chosen Mamelukes led on by Murad Bey, who was enamoured with the beauty of Ali Bey's wife, and had obtained the promise of her, provided that he could take Ali Bey captive. Murad wounded and made Ali Bey prisoner, and carried him up to Mohammed, who received him with affected respect: but in three days, either in consequence of poison or the effects of his wounds, Ali breathed his last.

Ali Bey was certainly a singular production in the school of ignorance and barbarity, and displayed a very great degree of original vigour of character and active penetration of mind. He is blamed for engaging in enterprises beyond his power to accomplish; but he is acknowledged to have been very favourable to the Franks, and to have governed Egypt with no small degree of steady moderation. He is also charged with devolving too much upon his lieutenants, and not being sufficiently attentive to the exactions made by his officers. Among his failings may also be ranked that

of an unbounded confidence in his favourite. Generosity and a sense of justice were not wanting in his character, although his morals, under the sanction of his class and country, were strongly tainted with perfidy and murder in the pursuit of his ambitious plans. (*Gen. Biog.*)

ALJAMEIA, is a name which the Moriscos in Spain give to the language of the Spaniards. Among other articles agreed on by the junta, which was appointed by the emperor Charles V. in 1526, in favour of the Moriscos, this was one, That the Moriscos should no longer speak *Algavareia*, i. e. Moorish, or Arabic; but should all speak *Aljameia*, i. e. Spanish, as it was called by the Moors, and all their writings and contracts should be in that language.

ALLAS, in *Law*, a second or farther writ issued from the courts of Westminster, after a *capias*, &c. sued out without effect.

ALIBI, in *Law*, denotes the absence of the accused from the place where he is charged with having committed a crime; or his being *elsewhere*, as the word imports, at the time specified.

ALICANT, a large sea-port town in the province of Valencia, and territory of Segura. It is seated between the mountains and the sea, and has a castle deemed impregnable. The port is defended by three bastions furnished with artillery. To prevent the visits of the Algerine pirates, watch-towers were built to give notice of the approach of an enemy's ship. It was taken from the Moors in 1264. The castle was taken by the English in 1706, and held out a siege of two years before it was retaken by the French and Spaniards, and at last surrendered upon honourable terms, after part of the rock was blown up on which the castle stood, and the governor killed. The houses are high, and well built; and a trade is carried on here in wine, fruit, and soap. It is seated on the Mediterranean, on a bay of the same name, 37 miles north-east of Murcia, and 75 south of Valencia, and contains about 16,950 inhabitants. W. Long. 0. 36. N. Lat. 38. 24.

ALICATA, a mountain of Sicily, near the valleys Mazara and Noto, upon which was situated (as is generally thought) the famous Dædalion, where the tyrant Phalaris kept his brazen bull.

ALICATA, a town of Sicily, remarkable for corn and good wine. It was plundered by the Turks in 1543; is seated on a sort of peninsula near the sea, 22 miles south-east of Girgenti, and contains 2700 houses. E. Long. 14. 2. N. Lat. 37. 11.

ALICATA *Chlamys*, was a sort of vest with sleeves worn by the Roman boys till the age of thirteen, at which time they put on the *pretexta*.

ALIEN, in *Law*, implies a person born in a strange country, not within the king's allegiance; in contradistinction to a denizen or natural subject. The word is formed from the Latin *alius*, "another;" q. d. one born in another country. An alien is incapable of inheriting lands in Britain till naturalized by an act of parliament. No alien is entitled to vote at the election of members of parliament: nor can he enjoy any office, or be returned on any jury, unless where an alien is party in a cause, when the inquest is composed of an equal number of denizens and aliens. The reasons for establishing these laws were, that every man is presumed to bear faith and love to that prince and country where he received protection during his infancy;

Alien,
Alienation.

cy; and that one prince might not settle spies in another's country; but chiefly that the rents and revenues of the country might not be drawn to the subjects of another. Some have thought that the laws against aliens were introduced in the time of Henry II. when a law was made at the parliament of Wallingford, for the expulsion of strangers, in order to drive away the Flemings and Picards introduced into the kingdom by the wars of King Stephen. Others have thought that the origin of this law was more ancient; and that it is an original branch of the feudal law: for by that law no man can purchase any lands but he must be obliged to do fealty to the lords of whom the lands are holden; so that an alien who owed a previous faith to another prince, could not take an oath of fidelity in another sovereign's dominions. Among the Romans only the *Cives Romani* were esteemed freemen; but when their territories increased, all the Italians were made free under the name of *Latins*, though they had not the privilege of wearing gold rings till the time of Justinian. Afterwards all born within the pale of the empire were considered as citizens.

ALIEN-Duty, an impost laid on all goods imported by aliens, over and above the customs paid for such goods imported by British subjects, and on British bottoms.

ALIENS-Duty is otherwise called *petty customs*, and *navigation-duty*.—Fish dried or salted, and cod-fish or herrings not caught in British vessels and cured by British subjects, pay a double *aliens-duty*.—On what footing aliens are permitted to import foreign commodities into Great Britain, see *DUTY*.

ALIEN Priories, a kind of inferior monasteries, formerly very numerous in England, and so called from their belonging to foreign abbeyes.

ALIENATION, in *Law*, denotes the act of making over a man's property in lands, tenements, &c. to another person.

ALIENATION in mortmain, is the making over lands, tenements, &c. to a body politic, or to a religious house, for which the king's license must first be obtained, otherwise the lands, &c. alienated will be forfeited.

ALIENATION in fee is the selling the fee-simple of any land or other incorporeal right. All persons who have a right to lands may generally alien them to others: but some alienations are prohibited; such as alienations by tenants for life, &c. whereby they incur a forfeiture of their estate. By the statute of Edward I. a bar was put to alienations by what we call *entails*, which is an expedient for procuring perpetuities in families; but counter-expedients were devised to defeat this intent, and a practice was introduced of cutting off entails by fines, and of barring remainders and reversions by recoveries. The statute for alienation in Henry VII.'s time had a great effect on the constitution of this kingdom; as, among other regulations of that reign, it tended to throw the balance of power more into the hands of the people. By the stat. 12 Car. II. cap. 24. fines for alienations are taken away. Crown lands are only alienable under a faculty of perpetual redemption. The council of Lateran, held in 1123, forbids any clerk to alienate his benefice, prebend, or the like. By the laws of the ancient Jews, lands could only be alienated for the space of 50 years. At each return of the jubilee all returned again to the primitive owners, or their de-

scendants, to whom the lands were originally allotted at the first distribution of Canaan.

ALIENATION-Office, is an office to which all writs of covenants and entry, upon which fines are levied, and recoveries suffered, are carried, to have fines for alienation set and paid thereon.

ALIMENT (from *alo*, to nourish), implies food both solid and liquid: from which, by the process of digestion, is prepared a very mild, sweet, and whitish liquor, resembling milk, and distinguished by the name of *chyle*; which being absorbed by the lacteal veins, by them conveyed into the circulation, and there assimilated into the nature of blood, affords that supply of nutrition which the continual waste of the body is found to require.—Next to air, food is the most necessary thing for the preservation of our bodies: and as on the choice thereof our health greatly depends, it is of great importance to understand, in general, what is the properest for our nourishment; and, in particular deviations from health, what is the best adapted to restore us. The blood and fluids naturally incline to waste and diminish: fresh chyle, duly received, prevents this waste and diminution, and preserves in them that mild state which alone consists with health. An animal diet affords the most of this bland nutritious mucilage; watery fluids dilute the too gross parts, and carry off what is become unfit for use. It is only the small portion of jelly which is separated from the farinaceous parts of vegetables, that, after being much elaborated, is converted into the animal nature; yet the use of vegetables prevents both repletion and a too great tendency to a putrescent acrimony of the blood. In hot climates, as well as against the constitutional heat of particular persons, vegetables are demanded in the largest proportion. Animal substances afford the highest relish while our appetite continues; but will sate the appetite before the stomach is duly filled. Vegetables may be eaten after either flesh or fish: few herbs or fruits satiate so much as that the stomach may not be filled with them, when it is already satisfied with flesh or fish; whence it may be observed, that no diet which is very nourishing can be eaten to fullness, because its nutritious parts are oily and satiating. Health depends almost wholly on a proper crasis of the blood; and to preserve this, a mixture of vegetables in some degree is always required, for a loathing is soon the consequence of animal food alone: hot acrid habits, too, receive from milk and vegetables the needful for correcting their excesses; but in cold, pituitous, and nervous habits, who want most nourishment from least digestion, and from the smallest quantity of food, animal diet is to be used more freely.

Thus much being offered as general principles with respect to the matter and quality of our aliment, the valetudinarian may easily regulate his diet with some advantage to himself by an attention to the few ensuing particulars. In winter, eat freely, but drink sparingly: roast meat is to be preferred, and what is drank should be stronger than at other seasons. In summer, let thirst determine the quantity to be drunk; cold stomachs never require much: boiled meats and vegetables, if not otherwise contraindicated, may now be more freely used. Lax habits require the winter's diet to be continued all the year, and rigid ones should be confined to that of summer. Fat people should fast

Alienation,
Aliment.

Aliment
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Aliquant.

at times, but the lean should never do so. Those who are troubled with eructations occasioned by their food should drink but little, and use some unaccustomed exercise. The thirsty should drink freely, but eat sparingly. In general, let moderation be observed; and though no dinner hath been had, a light supper is at all times to be preferred. After very high seasoned meats, a glass of water acidulated with the acid elixir of vitriol, or in very weak stomachs the sweet elixir of vitriol, is far more assistant to the work of digestion than brandy. See FOOD and DRINK in this work, and DIETETICS in the SUPPLEMENT.

Obligation of ALIMENT, in *Scots Law*, the natural obligation on parents to provide their children with the necessaries of life, &c. See *LAW Index*.

ALIMENTARI Pueri, &c. were certain children maintained and educated by the munificence of the emperors, in a sort of public places, not unlike our hospitals.—Trajan was the first who brought up any of these alimentary boys. He was imitated by Adrian. Antoninus Pius did the same for a number of maids, at the solicitation of Faustina; and hence, in some medals of that empress, we read PVELLAE FAVSTINIANAE.—Alexander Severus did the like at the request of Mamaea; and the maids thus educated were called *Mamæana*.

ALIMENTARY Duct or *Canal*, is a name given by Dr Tyson and some others to that part of the body through which the food passes from its reception into the mouth to its exit at the *anus*; including the *gula*, stomach, and intestines. See ANATOMY.

This duct has been said to be the true characteristic of an animal, or (in the jargon of the schools) *in proprium quarto modo*; no animal being without it. Plants receive their nourishment by the numerous fibres of their roots; but have no common receptacle for digesting the food received, or for carrying off the recrements. But in all, even the lowest degree of animal life, we may observe a stomach and intestines, even where we cannot perceive the least formation of any organ of the senses, unless that common one of feeling, as in oysters. *Phil. Trans.* N° 269, p. 776, *et seq.*

Dr Wallis brings an argument from the structure of the alimentary tube in man, to prove that he is not naturally carnivorous; to which Dr Tyson makes some objections. *Vid. Phil. Trans.* N° 260. p. 777.

ALIMENTARY Law, *lex alimentaria*, was an old law among the Romans, whereby children were obliged to find sustenance for their parents.

ALIMONY, in *Law*, implies that allowance which a married woman sues for, and is entitled to, upon any occasional separation from her husband. See *LAW Index*.

ALIPILARIUS, or *ALIPILUS*, in Roman antiquity, a servant belonging to the baths, whose business it was, by means of waxen plasters, and an instrument called *volSELLa*, to take off the hair from the arm-pits, and even arms, legs, &c. this being deemed a point of cleanliness.

ALIPTERIUM, αλειπτήριον, in antiquity, a place in the ancient *palestræ*, where the *athletæ* were anointed before their exercises.

ALIQUNT PART, in *Arithmetic*, is that number which cannot measure any other exactly without some

remainder. Thus 7 is an aliquant part of 16; for twice 7 wants two of 16, and three times 7 exceeds 16 by 5.

ALIQUNT PART, is that part of a number or quantity which will exactly measure it without any remainder. Thus 2 is an aliquot part of 4, 3 of 9, 4 of 16, &c.

ALISANDERS, or *ALEXANDERS*, in *Botany*. See *SMYRNIUM*, *BOTANY Index*.

ALISONTIA, or *ALISUNTIA*, in *Ancient Geography*, a river of Belgic Gaul, now *Alsitz*; which, rising on the borders of Lorraine, and running through that duchy, waters the city of Luxembourg, and, swelled by other rivulets, falls into the Sur.

ALITES, in Roman antiquity, a designation given to such birds as afforded matter of auguries by their flight.

ALKADARII, a sect among the Mahometans who deny any eternal, fixed, divine decrees, and are assertors of free-will. The word is formed from the Arabic *alkadar*, which signifies "decree." The Alkadarii are a branch of Motazalites, and stand opposed to the Algiabarii. See *ALGIABARII*.

ALKAHEST, or *ALCAHEST*, among alchemists, derived from a word which signifies *spirit of salt* or *all spirit*, was supposed to be an universal menstruum, capable of resolving all bodies into their principles. Van Helmont pretended he was possessed of such a menstruum.—It is likewise used by some authors for all fixed salts volatilized.

ALKALI, in *Chemistry*, denotes a particular class of salts. The word *alkali* is of Arabian origin, and was introduced into chemistry after it had been applied to a plant which still retains the name of *kali*. When this plant is burnt, the ashes washed in water, and the water evaporated to dryness, a white substance remains, which was called *alkali*. According to Albertus Magnus, who uses the word, it signifies *sæx amaritudinis*, "the dregs of bitterness." Alkali may be obtained from other substances beside *kali*. Chemists gradually discovered that bodies, differing from one another in several of their properties, had been confounded together under the same name. The word, in consequence, became general, and is now applied to all bodies which possess the following properties: 1. Incombustible. 2. A hot caustic taste. 3. Volatilized by heat. 4. Soluble in water even when combined with carbonic acid. 5. Capable of converting vegetable blues to green.

The alkalies at present known are three in number: 1. Potass; 2. Soda; 3. Ammonia. The two first are called *fixed alkalies*, because they require a red heat to volatilize them; the last is called *volatile alkali*, because it readily assumes a gaseous form, and consequently is dissipated by a very moderate degree of heat. See *CHEMISTRY Index*.

ALKALI, or *Sal Kali*. See *SALICORNIA*, *BOTANY Index*.

ALKANET. See *ANCHUSA*, *BOTANY Index*.

ALKEKENGI, the trivial name of a species of *physalis*. See *PHYSALIS*, *BOTANY Index*.

ALKENNA. See *LAWSONIA*, *BOTANY Index*.

ALKERMES, in *Pharmacy*, a compound cordial medicine made in the form of a confection, deriving its name from the kermes berries used in its composition.

ALKORAN,

Aliquot
||
Alkermes.

Alkoran
||
Allahabad.

ALKORAN. See ALCORAN.

ALL-HALLOWs. See *All SAINTS*.

ALL-Good. See CHENOPODIUM, BOTANY Index.

ALL-Heal. See HERACLEUM and STACHYS, BOTANY Index.

All-Saints, in the *Kalendar*, denotes a festival celebrated on the first of November, in commemoration of all the saints in general; which is otherwise called *All-Hallows*. The number of saints being so excessively multiplied, it was found too burdensome to dedicate a feast day to each. In reality, there are not days enough, scarce hours enough, in the year, for this purpose. Hence an expedient was had recourse to, by commemorating such in the lump as had not their own days. Boniface IV. in the ninth century, introduced the feast of *All-Saints* in Italy, which was soon after adopted in the other churches.

All-Saints, islands near Gaudaloupe in the West Indies.

All-Saints, a parish in Georgetown district, South Carolina, containing 2225 inhabitants, of whom 429 are whites, and 1795 slaves. It sends a member to each house of the state legislature.

All-Saints Bay, a spacious harbour near St Salvador in Brazil, in S. America, on the Atlantic ocean. W. Long. 49°. S. Lat. 12°.

All-Saints Bay, a captainship in the middle division of Brazil, so called from the harbour of that name; bounded on the north by the Rio Real; on the south by that of Las Ilheos; on the east by the ocean; and on the west by three unconquered nations of Indians. It is reckoned one of the richest and most fertile captainships in all Brazil, producing great quantities of cotton and sugar. The bay itself is about two and a half leagues over, interspersed with a number of small but pleasant islands, and is of prodigious advantage to the whole country. It has several cities and towns, particularly St Salvador, which is its capital. *All-Saints Bay* lies in S. Lat. 12. 3. W. Long. 40. 10. See SALVADOR.

All-Souls, in the *Kalendar*, denotes a feast-day, held on the second of November, in commemoration of all the faithful deceased.—The feast of *All-Souls* was first introduced in the eleventh century, by Odilon abbot of Cluny, who enjoined it on his own order; but it was not long before it became adopted by the neighbouring churches.

All-Spice. See MYRTUS and CALYCANTHUS, BOTANY Index.

ALLA, or ALLAH, the name by which the professors of Mahometanism call the Supreme Being.

The term *alla* is Arabic, derived from the verb *alaha*, to adore. It is the same with the Hebrew *Eloah*, which signifies the *Adorable Being*.

ALLAHABAD, in *Geography*, a province of Hindostan, about 160 miles in length, and 120 in breadth. Its eastern boundaries meet the province of Bahar, the southern Berar, the western Malwa and Agra, and the northern Oude. According to the distribution of the emperor Akbar, recorded in the Ayeen Akberry, it contains 10 circars or counties, which are divided into 177 pergunnahs or hundreds. According to the statement of Maurice, in his *Indian Antiquities*, it affords a revenue of 3,310,695 sicca rupees. It contributes to

the public service 323 elephants, 237,870 infantry, and 11,375 cavalry. The whole of this extensive province has been by conquest or treaty brought under the British government. Allahabad, Benares, and Iconpour, are the principal cities.

ALLAHABAD, the capital of the above province, is situated at the confluence of the great rivers Jumna and Ganges. This city is divided into two parts, called *the Old* and *the New Town*: The old is situated upon the Ganges, and the new upon the Jumna. The emperor Akbar erected a strong fortress of stone, which occupies a large space in this city, and from him it received its present name. Of this fortress, Mr Hodges, in N^o IV. of his *Select Views in India*, gives an accurate and elegant delineation. A pillar consisting of one stone 40 feet high, ascribed by tradition to Bima, one of the heroes of Mahabarat, wholly covered with illegible inscriptions, and the elegant tomb of Sultan Khusru, are excellent specimens of Mahometan architecture. Devotion has fixed her residence, and flourishes to such a degree in this city, that it hath obtained the appellation of "the king of worshipped places." According to the evidence of the Ayeen-Akberry, the adjacent territory, to the extent of 40 miles, is deemed holy ground. The Hindoos deem it a meritorious action for a man to slay himself here, although they teach that suicide will be punished with torments in a future state. In and about this city there are various objects of veneration, which immense numbers of pilgrims continue to visit with great devotion. Major Rennel has placed Palibothra on the same site with Patna; but Dr Robertson is of opinion that the ancient Palibothra is the modern city of Allahabad. N. Lat. 25. 27. E. Long. 82. 5.

ALLAMANDA, in *Botany*. See BOTANY Index.

ALLAN, DAVID, a Scottish historical painter. See SUPPLEMENT.

ALLAN, a river of Perthshire, in Scotland, which passes by Dunblane, and falls into the Forth near Stirling.

ALLANTOIS, or ALLANTOIDES, a thin transparent bag investing the foetus of quadrupeds, as cows, goats, sheep, &c. filled with an urinous liquor conveyed to it from the bladder of the young animals by means of the urachus. See ANATOMY Index.

ALLATIUS, LEO, keeper of the Vatican library, a native of Scio, and a celebrated writer of the 17th century. He was of great service to the gentlemen of Port Royal in the controversy they had with M. Claude touching the belief of the Greeks with regard to the eucharist. No Latin was ever more devoted to the see of Rome, or more inveterate against the Greek schismatics, than Allatius. He never was married; nor did he take orders; and Pope Alexander VII. having asked him one day, why he did not enter into orders? he answered, "Because I would not be free to marry." The pope rejoined, "if so, why do you not marry?" "Because," replied Allatius, "I would not be at liberty to take orders." Thus, as Mr Bayle observes, he passed his whole life, wavering betwixt a parish and a wife; sorry, perhaps at his death, for having chosen neither of them; when, if he had fixed upon one, he might have repented his choice for 30 or 40 years.—If we believe John Patricius, Allatius had a very extraordinary.

Allahabad
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Allatius.

Allatius
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Alleghany.

traordinary pen, with which, and no other, he wrote Greek for 40 years; at the loss of which, he was so grieved as to lament it with tears. He published several manuscripts, several translations of Greek authors, and several pieces of his own composing. In his works he discovers more erudition and industry than sound judgment. His manner of writing is diffuse and perplexed, making frequent digressions from one subject to another. He died at Rome, in 1669, aged 83.

ALLAY. See ALLOY.

ALLECTUS, the prime minister and confidential friend of Carausius, emperor of Britain. In order to avoid the punishment due to the several enormous crimes with which he was chargeable, he fell upon the desperate expedient of murdering his master, and usurping the imperial dignity, which he maintained for three years. With a design of recovering Britain, Constantius about this period fitted out a large squadron, which being assembled in the mouth of the Seine, the command was devolved upon the prefect Asclepiodotus. The fleet of Allectus was stationed off the Isle of Wight to receive them; but under the cover of a thick fog, the invaders escaped their notice, and landed in safety on the western coast, and, according to Gibbon, convinced the Britons "that a superiority of naval strength will not always protect their country from a foreign invasion." No sooner had the intrepid commander disembarked his forces, than he set fire to his ships, and marched forward to meet the enemy. In expectation of an attack from Constantius, who commanded the fleet off Boulogne, the usurper had taken his station in the vicinity of London; but informed of the descent of Asclepiodotus, he made forced marches to oppose his progress. Allectus attacked the imperial troops, and his army being reduced to a small number of fatigued and dispirited men, he fell in the field, and his forces received a total defeat. Thus, in one day, and by a single battle, the fate of this great island was decided; and Britain, after a separation of 10 years, was restored to the Roman empire, A. D. 297. Constantius landing on the shores of Kent, was saluted with the loud applauses and unanimous acclamation of obedient subjects, and welcomed to the British soil.

ALLEGATA, a word anciently subscribed at the bottom of rescripts and constitutions of the emperors; as *signata*, or *testata*, was under other instruments.

ALLEGEAS, or ALLEGIAS, a stuff manufactured in the East Indies. There are two sorts of them: some are of cotton, and others of several kinds of herbs, which are spun like flax and hemp. Their length and breadth are of eight ells, by five, six, or seven eighths; and of twelve ells, by three-fourths or five-eighths.

ALLEGHANY MOUNTAINS, between the Atlantic ocean, the Mississippi river, and the lakes, are a long and broad range of mountains, made up of a great number of ridges, extending north-easterly and south-westerly, nearly parallel to the sea coast, about 900 miles in length, and from 60 to 150 miles in breadth. The different ridges which compose this immense range of mountains, have different names in the different states, viz. the *Blue Ridge*, the *North mountain*, or *North ridge*, or *Devil's Back-Bone*, *Laurel ridge*, *Jackson's mountains*, and *Kittatinny mountains*. All these different and immense ridges, except the *Alleghany*, are

broken through by rivers, which appear to have forced their way through solid rocks. This principal ridge is more immediately called *Alleghany*, and is descriptively named the *Back-bone of the United States*. From these several ridges proceed innumerable branches, or spurs. The general name of the whole range, taken collectively, is the *Alleghany mountains*. Mr Evans calls them the *Endless mountains*; others have called them the *Appalachian mountains*, from a tribe of Indians who live on a river which proceeds from this mountain, called the *Appalachicola*; but the most common name is the *Alleghany mountains*, so called, probably, from the principal ridge of the range.

They pass through the states eastward of the Mississippi like a spine or back-bone, and give rise to nearly all the rivers in that region. They approach the sea at New York, but take a direction inland from that point, and in Georgia are above 200 miles from the sea. They are generally covered with natural wood, and capable of cultivation, with some exceptions. The soil in the valleys between the ridges is found to be superior to that between the mountains and the sea, and is indeed among the best in the United States. Towards the northern extremity of the Alleghanies, the primitive rocks cover a great breadth of country; but southward of New York they are chiefly confined to the eastern slope of the mountains. A zone of transition rocks from 20 to 40 miles in breadth, extends nearly the whole length of the chain; and beyond this to the westward the country is chiefly limestone. They are not confusedly scattered, but run along in ridges generally of a uniform height, estimated on an average at 3000 feet. The ground rises to them from the sea so gradually that their height does not strike the eye much. They contain a considerable variety of minerals, and on the western side great beds of coal.

ALLEGHANY River, in Pennsylvania, rises on the western side of the Alleghany mountains, and after running about 200 miles in a south-west direction, meets the Monongahela at Pittsburg, and both united form the Ohio. The lands on each side of this river, for 150 miles above Pittsburg, consist of white oak and chesnut ridges, and in many places of poor pitch pines, interspersed with tracts of good land, and low meadows. This river, and the Ohio likewise, from its head waters until it enters the Mississippi, are known and called by the name of *Alleghany River*, by the Seneka and other tribes of the Six Nations, who once inhabited it.

ALLEGIANCF, in *Law*, is the tie, or *ligamen*, which binds the subject to the king, in return for that protection which the king affords the subject. The thing itself, or substantial part of it, is founded in reason and the nature of government; the name and the form are derived to us from our Gothic ancestors. Under the feudal system, every owner of lands held them in subjection to some superior or lord, from whom or from whose ancestors the tenant or vassal had received them; and there was a mutual trust or confidence subsisting between the lord and vassal, that the lord should protect the vassal in the enjoyment of the territory he had granted him; and, on the other hand, that the vassal should be faithful to the lord, and defend him against all his enemies. This obligation on the part of the vassal was called his

Alleghany,
Allegiance.

Allegiance *fidelitas* or fealty: and an oath of fealty was required by the feudal law to be taken by all tenants to their landlord, which is couched in almost the same terms as our ancient oath of allegiance; except that, in the usual oath of fealty, there was frequently a saving or exception of the faith due to a superior lord by name, under whom the landlord himself was perhaps only a tenant or vassal. But when the acknowledgment was made to the absolute superior himself, who was vassal to no man, it was no longer called the oath of fealty, but the oath of allegiance; and therein the tenant swore to bear faith to his sovereign lord, in opposition to all men, without any saving or exception. Land held by this exalted species of fealty, was called *feudum ligium*, a liege fee; the vassals *homines ligii*, or liege men; and the sovereign, their *dominus ligius*, or liege lord. And when sovereign princes did homage to each other for lands held under their respective sovereignties, a distinction was always made between *simple* homage, which was only an acknowledgment of tenure; and *liege* homage, which included the fealty before mentioned, and the services consequent upon it. In Britain, it becoming a settled principle of tenure, that all lands in the kingdom are holden of the king as their sovereign and lord paramount, no oath but that of fealty could ever be taken to inferior lords; and the oath of allegiance was necessarily confined to the person of the king alone. By an easy analogy, the term of *allegiance* was soon brought to signify all other engagements which are due from subjects to their prince, as well as those duties which were simply and merely territorial. And the oath of allegiance, as administered in England for upwards of 600 years, contained a promise to be true and faithful to the king and his heirs, and truth and faith to bear of life and limb and terrene honour, and not to know or hear of any ill or damage intended him, without defending him therefrom." But, at the Revolution, the terms of this oath being thought perhaps to savour too much of the notion of non-resistance, the present form was introduced by the convention parliament, which is more general and indeterminate than the former; the subject only promising "that he will be faithful and bear true allegiance to the king," without mentioning "his heirs," or specifying in the least wherein that allegiance consists. The oath of supremacy is principally calculated as a renunciation of the pope's pretended authority: and the oath of abjuration, introduced in the reign of King William, very amply supplies the loose and general texture of the oath of allegiance; it recognising the right of his majesty, derived under the act of settlement engaging to support him to the utmost of the juror's power; promising to disclose all traitorous conspiracies against him; and expressly renouncing any claim on the descendants of the late pretender, in as clear and explicit terms as the English language can furnish. This oath must be taken by all persons in any office, trust, or employment; and may be tendered by two justices of the peace to any person whom they shall suspect of disaffection. And the oath of allegiance may be tendered to all persons above the age of twelve years, whether natives, denizens, or aliens.

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But, besides these *express* engagements, the law also holds that there is an *implied, original, and virtual* al-

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legiance, owing from every subject to his sovereign, antecedently to any express promise, and although the subject never swore any faith or allegiance in form. Thus Sir Edward Coke very justly observes, that "all subjects are equally bounden to their allegiance as if they had taken the oath; because it is written by the finger of the law in their hearts, and the taking of the corporal oath is but an outward declaration of the same."

Allegiance, both express and implied, is however distinguished by the law into two sorts or species, the one *natural*, the other *local*; the former being also perpetual, the latter temporary.

Natural allegiance is such as is due from all men born within the king's dominions immediately upon their birth. For, immediately upon their birth they are under the king's protection; at a time too, when (during their infancy) they are incapable of protecting themselves. Natural allegiance is, therefore, a debt of gratitude; which cannot be forfeited, cancelled, or altered, by any change of time, place, or circumstance, nor by any thing but the united concurrence of the legislature. A Briton who removes to France, or to China, owes the same allegiance to the king of Britain there as at home, and 20 years hence as well as now. For it is a principle of universal law, That the natural-born subject of one prince cannot by any act of his own, no, not by swearing allegiance to another, put off or discharge his natural allegiance to the former: for this natural allegiance was intrinsic and primitive, and antecedent to the other; and cannot be divested without the concurrent act of that prince to whom it was first due.

Local allegiance is such as is due from an alien, or stranger born, for so long a time as he continues within the king's dominion and protection; and it ceases the instant such stranger transfers himself from this kingdom to another. Natural allegiance is therefore *perpetual*, and local *temporary* only; and that for this reason, evidently founded upon the nature of government, That allegiance is a debt due from the subject, upon an implied contract with the prince; that so long as the one affords protection, so long the other will demean himself faithfully.

The *oath* of allegiance, or rather the *allegiance* itself, is held to be applicable, not only to the political capacity of the king, or regal office, but to his natural person and blood royal: and for the misapplication of their allegiance, viz. to the regal capacity or crown, exclusive of the person of the king, were the Spencers banished in the reign of Edward II. And from hence arose that principle of personal attachment and affectionate loyalty, which induced our forefathers (and, if occasion required, would doubtless induce their sons) to hazard all that was dear to them, life, fortune, and family, in defence and support of their liege lord and sovereign.

It is to be observed, however, in explanation of this allegiance, That it does not preclude resistance to the king, when his misconduct or weakness is such as to make resistance beneficial to the community. It seems fairly presumable, that the convention parliament, which introduced the oath of allegiance in its present form, did not intend to exclude all resistance: since the

*Paley's
Moral and
Political
Philosophy.*

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very

Allegiance, very authority by which the members sat together, was
 Allegory. itself the effect of a successful opposition to an acknowledged sovereign.

Again : The allegiance above described can only be understood to signify obedience to lawful commands. If therefore, the king should issue a proclamation, levying money or imposing any service or restraint upon the subject, beyond what the law authorized, there would exist no sort of obligation to obey such a proclamation, in consequence of having taken the oath of allegiance.

Neither can allegiance be supposed to extend to the king after he is actually and absolutely deposed, driven into exile, or otherwise rendered incapable of exercising the regal office. The promise of allegiance implies, that the person to whom the promise is made continues king ; that is, continues to exercise the power, and afford the protection, which belong to the office of king ; for it is the possession of these which makes such a particular person the object of the oath.

ALLEGORY, in *Composition*, consists in choosing a secondary subject, having all its properties and circumstances resembling those of the principal subject, and describing the former in such a manner as to represent the latter. The principal subject is thus kept out of view, and we are left to discover it by reflection. In other words, an allegory is, in every respect, similar to a hieroglyphical painting, excepting only that words are used instead of colours. Their effects are precisely the same : A hieroglyphic raises two images in the mind ; one seen, that represents one that is not seen : An allegory does the same ; the representative subject is described, and the resemblance leads us to apply the description to the subject represented.

There cannot be a finer or more correct allegory than the following, in which a vineyard is made to represent God's own people the Jews :

"Thou hast brought a vine out of Egypt ; thou hast cast out the heathen, and planted it. Thou didst cause it to take deep root, and it filled the land. The hills were covered with its shadow, and the boughs thereof were like the goodly cedars. Why hast thou then broken down her hedges, so that all that pass do pluck her ? The boar out of the wood doth waste it, and the wild beast doth devour it. Return, we beseech thee, O God of hosts : look down from heaven, and behold, and visit this vine and the vineyard thy right hand hath planted, and the branch thou madest strong for thyself," Psal. lxxx.

Nothing gives greater pleasure than an allegory, when the representative subject bears a strong analogy, in all its circumstances, to that which is represented. But most writers are unlucky in their choice, the analogy being generally so faint and obscure, as rather to puzzle than to please. Allegories, as well as metaphors and similies, are unnatural in expressing any severe passion which totally occupies the mind. For this reason, the following speech of Macbeth is justly condemned by the learned author of the *Elements of Criticism* :

Methought I heard a voice cry, Sleep no more !
 Macbeth doth murder Sleep ; the innocent sleep ;
 Sleep that knits up the ravell'd sleeve of Care,
 The birth of each day's life, sore Labour's bath,

Balm of hurt minds, great Nature's second course,
 Chief nourisher in life's feast. *Act ii. sc. 3.*

Allegory,
 Allegri.

But see this subject more fully treated under the article *METAPHOR and Allegory*.

ALLEGRI, ANTONIO, called *Corregio* from the place of his birth, an eminent historical painter, was born in the year 1494. Being descended of poor parents, and educated in an obscure village, he enjoyed none of those advantages which contributed to form the other great painters of that illustrious age. He saw none of the statues of ancient Greece or Rome ; nor any of the works of the established schools of Rome and Venice. But Nature was his guide ; and Corregio was one of her favourite pupils. To express the facility with which he painted, he used to say that he always had his thoughts ready at the end of his pencil.

The agreeable smile, and the profusion of graces, which he gave to his madonas, saints, and children, have been taxed with being sometimes unnatural ; but still they are amiable and seducing : An easy and flowing pencil, an union and harmony of colours, and a perfect intelligence of light and shade, give an astonishing relief to all his pictures, and have been the admiration both of his cotemporaries and his successors. Annibal Caracci, who flourished 50 years after him, studied and adopted his manner in preference to that of any other master. In a letter to his cousin Lonis, he expressed with great warmth the impression which was made on him by the first sight of Corregio's paintings : "Every thing which I see here (says he) astonishes me ; particularly the colouring and the beauty of the children. They live—they breathe—They smile with so much grace and so much reality, that it is impossible to refrain from smiling and partaking of their enjoyment. My heart is ready to break with grief when I think on the unhappy fate of poor Corregio—that so wonderful a man (if he ought not rather to be called an angel) should finish his days so miserably, in a country where his talents were never known !"—

From want of curiosity or of resolution, or from want of patronage, Corregio never visited Rome, but remained his whole life at Parma, where the art of painting was little esteemed, and of consequence poorly rewarded. This occurrence of unfavourable circumstances occasioned at last his premature death at the age of 40. He was employed to paint the cupola of the cathedral at Parma, the subject of which is an assumption of the Virgin : and having executed it in a manner that has long been the admiration of every person of good taste, for the grandeur of design, and especially for the boldness of the fore-shortenings (an art which he first, and at once brought to the utmost perfection), he went to receive his payment. The canons of the church, either through ignorance or baseness, found fault with his work ; and although the price originally agreed upon had been very moderate, they alleged that it was far above the merit of the artist, and forced him to accept of the paltry sum of 200 livres ; which, to add to the indignity, they paid him in copper money. To carry home this unworthy load to his indigent wife and children, poor Corregio had to travel six or eight miles from Parma. The weight

Allegri. of his burden, the heat of the weather, and his chagrin at this villanous treatment, immediately threw him into a pleurisy, which in three days put an end to his life and his misfortunes.

For the preservation of this magnificent work the world is indebted to Titian. As he passed through Parma, in the *suite* of Charles V. he run instantly to see the *chef d'œuvre* of Corregio. While he was attentively viewing it, one of the principal canons of the church told him that such a grotesque performance did not merit his notice, and that they intended soon to have the whole defaced. "Have a care of what you do, (replied the other): If I were not Titian, I would certainly wish to be Corregio."

Corregio's exclamation upon viewing a picture by Raphael is well known. Having long been accustomed to hear the most unbounded applause bestowed on the works of that divine painter, he by degrees became less desirous than afraid of seeing any of them. One, however, he at last had occasion to see. He examined it attentively for some minutes in profound silence; and then with an air of satisfaction exclaimed, *I am still a painter*. Julio Romano, on seeing some of Corregio's pictures at Parma, declared they were superior to anything in painting he had yet beheld. One of these no doubt would be the famous Virgin and Child, with Mary Magdalen and St Jerome: but whether our readers are to depend upon his opinion, or upon that of Lady Millar, who in her *Letters from Italy* gives a very unfavourable account of it, we shall not presume to determine. This lady, however, speaks in a very different style of the no less famous *Notte* or Night of Corregio, of which she saw only a copy in the duke's palace at Modena, the original having been sold for a great sum of money to the king of Poland. "It surprises me very much (says she), to see how different the characters are in this picture from that which I already have described to you. The subject is a Nativity; and the extraordinary beauty of this picture proceeds from the *clair obscure*: there are two different lights introduced, by means of which the personages are visible; namely, the light proceeding from the body of the child, and the moon light. These two are preserved distinct, and produce a most wonderful effect. The child's body is so luminous, that the superficies is nearly transparent, and the rays of light emitted by it are verified in the effect they produce upon the surrounding objects. They are not rays distinct and separate, like those round the face of a sun that indicates an insurance office; nor linear, like those proceeding from the man in the almanack; but of dazzling brightness; by their light you see clearly the face, neck, and hands, of the Virgin (the rest of the person being in strong shadow), the faces of the *pastori* who crowd round the child, and particularly one woman, who holds her hand before her face, lest her eyes should be so dazzled as to prevent her from beholding the infant. This is a beautiful natural action, and is most ingeniously introduced. The straw on which the child is laid appears gilt, from the light of his body shining on it. The moon lights up the back ground of the picture, which represents a landscape. Every object is distinct, as in a bright moonlight night; and there cannot be two lights in nature more different than those which appear in the

same picture. The virgin and the child are of the most perfect beauty. There is a great variety of character in the different persons present, yet that uniformity common to all herdsmen and peasants. In short, this copy is so admirable, that I was quite sorry to be obliged to lose sight of it so soon; but I never shall forget it. The duke of Modena, for whom Corregio did the original picture, gave him only 600 livres of France for it; a great sum in those days: but at present, what ought it to cost?" This great painter's death happened in 1534.

ALLEGRI, Gregorio, an ecclesiastic by profession, and a celebrated composer of music of the seventeenth century, was a native of Rome. He was the disciple of Nanini, the intimate friend and contemporary of Palestrina. His abilities as a singer were not remarkable, but he was deemed an excellent master of harmony; and so much respected by all the musical professors of his time, that the pope, in the year 1629, appointed him to be one of the singers of his chapel. To his uncommon merit as a composer of church music, he united an excellent moral character, exhibiting in his actions the devotion and benevolence of his heart. The poor crowded daily to his door, whom he relieved to the utmost of his ability; and not content with these beneficent actions, he daily visited the prisons of Rome, in order to relieve the most deserving and afflicted objects which were immured in these dreary mansions. With such divine simplicity and purity of harmony, did he compose many parts of the church service, that his loss was severely felt and sincerely lamented by the whole college of singers in the papal service. He died Feb. 18. 1650, and was interred in the Chiesa Nuova, in a vault destined for the reception of deceased singers in the pope's chapel, before the chapel of S. Filippo Neri, near the altar of annunciation.

Among his other musical works preserved in the pontifical chapel, is the celebrated *miserere*, which, for 170 years, has been annually performed at that chapel on Wednesday and Good Friday, in Passion week, by the choral band, and the best singers in Italy. It is, however, generally believed, that it owes its reputation more to the manner in which it is performed, than to the composition itself. The beauty and effect of the music is not discernible upon paper, but the singers have, by tradition, certain customs, expressions, and graces of convention, which produce wonderful effects. Some of the effects produced may be justly attributed to the time, the place, and the solemnity of the ceremonies observed during the performance. "The pope and conclave are all prostrated on the ground, the candles of the chapel and the torches of the ballustrade are extinguished one by one, and the last verse of this psalm is terminated by two choirs; the *maestra di cappello* beating time slower and slower, and the singers diminishing, or rather extinguishing the harmony by little and little, to a perfect point." Padre Martini says, that there was never more than three copies made by authority, "one of which was for the emperor Leopold, one for the late king of Portugal, and the other for himself: but a very complete one was presented by the pope himself to King George III. as an inestimable curiosity." (*Gen. Biog.*)

ALLEGRO, in *Music*, an Italian word, denoting that

Allegro,
Allein.

that the part is to be played in a sprightly, brisk, lively and gay manner.

Piu ALLEGRO, signifies that the part it is joined to should be sung or played quicker; as

Pocu piu ALLEGRO intimates, that the part to which it refers ought to be played or sung only a little more briskly than allegro alone requires.

ALLEIN, JOSEPH, the son of Tobias Allein, was born in the Devizes, in Wiltshire, in 1633, and educated at Oxford. In 1655, he became assistant to Mr Newton, in Taunton Magdalen, in Somersetshire; but was deprived for nonconformity. He died in 1668, aged 35. He was a man of great learning, and greater charity; preserving, though a nonconformist, and a severe sufferer on that account, great respect for the church, and loyalty to his sovereign. He wrote several books of piety, which are highly esteemed; but his *Alarm to unconverted sinners* is more famous than the rest. There have been many editions of this little pious work, the sale of which has been very great; of the edition 1672, there were 20,000 sold; of that of 1675, with this title, *A sure guide to heaven*, 50,000. There was also a large impression of it with its first title, in 1720.

ALLEIN, Richard, an English nonconformist divine, a native of Ditchet, in Somersetshire, was born in the year 1611. His father was rector of Ditchet, and conducted the education of his son, until he was prepared for the university. There he soon obtained the degree of master of arts, and after he entered into holy orders, first as an assistant to his father, and afterwards as rector of Batcomb, in Somersetshire, he discharged the duties of a clergyman with great industry and singular fidelity. From his education, he conceived an early predilection for the sentiments of the Puritans, and consequently, in the contest between Charles I. and the parliament, he firmly adhered to the latter. Having adopted these sentiments, he sometimes received a little disturbance from the king's forces, but he never carried his opposition to any undue length. He, along with several others, signed a paper, entitled "The testimony of the Ministers of Somersetshire to the truth of Christ," in which their declared principles and becoming candour were amply displayed. Along with his father, he was employed by the commissioners appointed by parliament for ejecting scandalous ministers; a commission which was executed with rigour, and originated in intolerance.

Upon the Restoration he manifested a disposition to loyalty, but unable with a good conscience to unite in the act of conformity, he resigned his living after enjoying it for 20 years, and ranked with the meritorious band of sufferers, to the number of 2000, commonly denominated the *ejected ministers*. In the house of Mr More, who had been a member of the parliament, he exercised the duties of his ministerial office under the penalty of that act, and was consequently reprimanded by the magistrates and imprisoned; but his piety and exemplary conduct procured him a mitigation of punishment. But no dangers could deter him from duty; for although constrained to remove from that place in consequence of the "five-mile act," he continued in the discharge of his ministerial office at Frome-Selwood. Here he remained until he terminated his labours by death, in 1681.

Piety, boldness, activity, and candour, shone in the character of Richard Allein. He was admired as a pathetic and practical preacher, and justly respected for the diligence with which he discharged the public and private duties of his profession. Mr Jenkins, the vicar of the parish where he resided, preached his funeral sermon, and bore an honourable testimony to his activity, moderation, and piety. Richard Allein, similar to his nonconformist brethren, chiefly confined his studies and publications to subjects of religion. His works are strongly marked with the peculiar features of the religious character then prevalent among the nonconformists. They have been frequently reprinted, and very much perused. His most celebrated work is "*Vindicie Pietatis*, or a Vindication of Godliness in its greatest Strictness and Spirituality, with directions for a godly life;" this book was published in 1665, without a printer's name; and being unlicensed, the copies of it were seized and sent to the king's kitchen for waste paper. The other productions of his pen are, "Heaven opened, or a brief and plain discovery of the riches of God's Covenant of Grace;" printed in 1665. "The World Conquered;" published in 8vo, in 1668. "Godly Fear," printed in 8vo, in 1674. "A Rebuke to Backsliders, and a Spur for Loiterers;" printed in 8vo in 1677. "A Companion for Prayer;" in 12mo, 1680. "A brief character of Mr Joseph Allein;" and "Instructions about heart-work, what is to be done on God's part and ours for the cure and keeping of the heart;" a posthumous piece published in 8vo, by Dr Annesley in the year 1681. (*Gen. Biog.*)

ALLELUIAH, or HALLELUIAH, a word signifying, *Praise the Lord*, to be met with either at the beginning or end of some psalms: such as psalm cxlv. and those that follow to the end. Alleluiah was sung upon solemn days of rejoicing, Tobit xiii. 12. St John in the Revelation (xix. 1, 3, 4, 6.) says, that he "heard a great voice of much people in heaven, who said, Alleluiah; and the four and twenty elders, and the four beasts, fell down and worshipped God that sat on the throne, saying, Alleluiah." This hymn of joy and praises was transferred from the synagogue to the church. St Jerome tells us, that at the funeral of Fabiola several psalms were sung with loud alleluiahs; and that the monks of Palestine were awakened at their midnight watchings, with the singing of alleluiahs. So much energy has been observed in this term, that the ancient church thought proper to preserve it, without translating it either into Greek or Latin, for fear of impairing the genius and softness of it. The fourth council of Toledo has prohibited the use of it in time of Lent, or other days of fasting, and in the ceremonies of mourning; and, according to the present practice of the Romish church, this word is never repeated in Lent, nor in the obsequies of the dead; notwithstanding which, it is used in the mass for the dead, according to the Mosarabic ritual, at the introit, when they sing, *Tu es portio mea, Domine, Alleluiah, in terra viventium, Alleluiah, Alleluiah*. The singing alleluiah was oftentimes an invitatory or call to each other to praise the Lord.

ALLEMAENGEL, a small Moravian settlement on Swetara river, in Pennsylvania.

ALLEMAND, a sort of grave solemn music, with good

Allein
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Allemand.

Allen and
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Allen.

good measure, and a slow movement. It is also a brisk kind of dance, very common in Germany and Switzerland.

ALLEMAND, a river which falls into the Mississippi from the south-east, about 43 miles south of the Natches.

ALLEMANNIC, in a general sense, denotes any thing belonging to the ancient Germans. Thus, we meet with Allemannic history, Allemannic language, Allemannic law, &c.

ALLEN, JOHN, archbishop of Dublin in the reign of King Henry VIII. was educated in the university of Oxford; from whence removing to Cambridge, he there took the degree of bachelor of laws. He was sent by Dr Warham, archbishop of Canterbury, to the pope, about certain matters relating to the church. He continued at Rome nine years; and was created doctor of laws, either there or in some other university of Italy. After his return, he was appointed chaplain to Cardinal Wolsey, and was commissary or judge of his court as legate *à latere*: in the execution of which office he was suspected of great dishonesty, and even perjury. He assisted the cardinal in visiting, and afterwards suppressing, 40 of the smaller monasteries, for the erection of his college at Oxford and that at Ipswich. The cardinal procured for him the living of Dalby in Leicestershire, though it belonged to the master and brethren of the hospital of Burton-Lazars. About the latter end of the year 1525 he was incorporated doctor of laws in the university of Oxford. On the 13th of March 1528 he was consecrated archbishop of Dublin, in the room of Dr Hugh Inge deceased; and about the same time was made chancellor of Ireland. He wrote, 1. *Epistola de Pallii significatione activa et passiva*; penned by him at the time when he received the archiepiscopal pall. 2. *De consuetudinibus ac statutis in tutoriis causis observandis*. He wrote also several other pieces relating to the church. His death, which happened in July 1534, was very tragical; for being taken in a time of rebellion by Thomas Fitzgerald, eldest son to the earl of Kildare, he was by his command most cruelly murdered, being brained like an ox, at Tartaine in Ireland, in the 58th year of his age. The place where the murder was committed was afterwards hedged in, overgrown, and unfrequented, in detestation of the fact.

ALLEN, Thomas, a famous mathematician of the 16th century, born at Uttoxeter in Staffordshire the 21st of December 1542. He was admitted scholar of Trinity college, Oxford, the 4th of June 1561; and in 1567 took his degree of master of arts. In 1580 he quitted his college and fellowship, and retired to Gloucester-hall; where he studied very closely, and became famous for his knowledge in antiquity, philosophy, and mathematics. Having received an invitation from Henry earl of Northumberland, a great friend and patron of the mathematicians, he spent some time at the earl's house, where he became acquainted with those celebrated mathematicians Thomas Harriot, John Dee, Walter Warner, and Nathaniel Torporley. Robert earl of Leicester had a particular esteem for Mr Allen, and would have conferred a bishopric upon him, but his love of solitude and retirement made him decline the offer. His great skill in the mathematics made the ignorant and vulgar look upon him as a magician or con-

juror: the author of a book entitled *Leicester's Commonwealth*, has accordingly accused him of using the art of figuring, to procure the earl of Leicester's unlawful designs, and endeavouring by the black art to bring about a match betwixt him and Queen Elizabeth. But without pretending to point out the absurdity of the charge, it is certain that the earl placed such confidence in Allen, that nothing material in the state was transacted without his knowledge; and the earl had constant information, by letter from Mr Allen, of what passed in the university. Mr Allen was very curious and indefatigable in collecting scattered manuscripts relating to history, antiquity, astronomy, philosophy, and mathematics: these collections have been quoted by several learned authors, &c. and mentioned to have been in the Bibliotheca Alleniana. He published in Latin the second and third books of Claudius Ptolemy of Pelusium, *Concerning the Judgment of the Stars*, or, as it is commonly called, of the *Quadripartite Construction*; with an exposition. He wrote also notes on many of Lilly's books, and some on John Bale's work *De Scripturis M. Britanniae*. Having lived to a great age, he died at Gloucester-hall on the 30th September 1632.

ALLENDORF, a small town in the circle of the Upper Rhine, and in the landgravate of Hesse Cassel, remarkable for its salt works, and three stone bridges. It is seated on the river Weser, 15 miles east of Cassel. E. Long. 10. 5. N. Lat. 51. 26.

ALLENSTOWN, a town in New Jersey, in Monmouth county, 15 miles north-east from Burlington, and 13 south-by-east from Princeton.

ALLENSTOWN, a township in Rockingham county, New Hampshire, containing 254 inhabitants: situated on the east side of Merrimack river, 25 miles north-west of Exeter, and 40 from Portsmouth.

ALLENTOWN, in Pennsylvania, Northampton county, on the point of land formed by Jordan's creek, and the Little Lehigh. It contains about 90 houses, and an academy.

ALLER, a river which runs through the duchy of Lunenburg, and falls into the Weser a little below Verden.

ALLER-good, in our ancient writers. The word *aller* serves to make the expression of superlative signification. So, *aller-good* is the greatest good. Sometimes it is written *alder*.

ALLERION, or ALERION, in *Heraldry*, a sort of eagle without beak or feet, having nothing perfect but the wings. They differ from martlets by having their wings expanded, whereas those of the martlets are close; and denote imperialists vanquished and disarmed: for which reason they are more common in French than in German coats of arms.

ALLESTRY, RICHARD, D. D. was born at Uppington in Shropshire, in 1619, was educated in the grammar school of Coventry, and afterwards at Christ-church in Oxford. His natural talents, which were uncommonly vigorous, he carefully improved by an unwearied application to study. Accordingly, his promotion was rapid. First he obtained the degree of bachelor of arts; next he was chosen moderator in philosophy; then made a canon of Christ-church, created doctor of divinity, appointed chaplain in ordinary to the king, and afterwards regius professor of divinity.

But in the early part of life his studies were interrupted,

Allen
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Allestry.

Allestry. rupted, and he was called to military service by hostile occurrences of the times. In the year 1641, he, along with many other students of Oxford, entered the royal service, and gave eminent proofs of their courage and loyal attachment. A short interval of hostilities permitted them to return to their literary pursuits; but a republican party soon after disturbed their repose, and entering Oxford, attempted to plunder the colleges. Having entered the treasury, and finding nothing but fourpence and a halter, they hastened to the deanery, and seizing many valuable articles, they locked them in an apartment, intending next day to carry them along with them. During the night, however, Allestry having a key to that apartment, found means to remove the whole of the articles. Informed that he was the cause of their disappointment, they seized him; and had they not been unexpectedly called off by an order of the earl of Essex, they would have severely wrecked their indignation upon him. In October following he again took up arms, was present at the battle of Keinton-field, and on his way to Oxford to prepare for the reception of the king he was taken prisoner, but soon afterwards released by the king's forces.

A violent disease which then prevailed in the garrison of Oxford, brought Allestry to the brink of the grave; but recovering, he again joined a regiment of volunteers, chiefly consisting of Oxford students. Here he served as a common soldier, and was often seen with the musket in one hand and the book in the other. When the republican party prevailed, he returned at the termination of the war to his favourite studies, but still continued true to that side of politics which he had adopted. This conduct occasioned his expulsion from the college; but he was provided with a comfortable retreat in the families of the honourable Francis Newport, and Sir Anthony Cope.

Such was the confidence reposed in him, that, when the friends of Charles II. were secretly preparing the way for his restoration, they entrusted him with personal messages to the king. In returning from one of these interviews, he was seized at Dover, and upon examination committed a prisoner to Lambeth-house. The earl of Shaftesbury obtained his release in a few weeks. Returning to visit his friends, and among others the learned Dr Hammond, he met his corpse at the gate of his house, carrying to the grave. This deeply afflicted his mind, and added much to his present distresses. The doctor left him his valuable library, assigning as a reason that "he well knew that his books in his hands would be useful weapons, for the defence of that cause he had so vigorously supported." This valuable library, along with his own, Allestry bequeathed at his death to the university.

During his life he erected at his own private expense the west side of the outward court of Eton college, the grammar school in Christ-church college, and settled several liberal pensions upon individual persons and families. His original biographer gives him the following character. "Memory, fancy, judgment, elocution, great modesty, and no less assurance, a comprehension of things, and a fluency of words; an aptness for the pleasant, and sufficiency for the rugged parts of knowledge; a courage to encounter and an industry to master all things, make up the character of his happy genius. There was not in the world a man of

clearer honesty and courage; no temptation could bribe him to do a base thing, or terror affright him from the doing a good one. This made his friendship as lasting and inviolable as his life, without the mean considerations of profit, or sly reserves of craft; without the pageantry of ceremonious address, the cold civility of some, and the servile falseness and obsequious flattery of others." He left a volume of sermons printed at Oxford in 1684, from the perusal of which posterity may judge of his literary abilities. Although his lectures gave universal satisfaction, yet he prohibited their publication.

ALLESTRY, Jacob, an English poet of the last century. He was the son of James Allestry, a bookseller of London, who was ruined by the great fire in 1666. Jacob was educated at Westminster school, entered at Christ church, Oxford, in the act-term 1671, at the age of 18, and was elected student in 1672. He took the degree of arts; was music reader in 1679, and terræ filius in 1681; both which offices he executed with great applause, being esteemed a good philologist and poet. He had a chief hand in the verses and pastorals spoken at the theatre at Oxford, May 21. 1681, by Mr William Saville, second son of the marquis of Halifax, and George Cholmondely, second son of Robert Viscount Kells (both of Christ-church), before James duke of York, his duchess, and the lady Anne; which verses and pastorals, were afterwards printed in the "Examen Poeticum." He died October 15. 1686, and was buried in St Thomas's church-yard.

ALLEVEURE, a small brass Swedish coin, worth about $\frac{1}{4}$ d. English money,

ALLEVIATION, denotes the making a thing lighter, and easier to bear or endure. It stands opposite to *aggravation*.

ALLEY, WILLIAM, bishop of Exeter in the reign of Queen Elizabeth, was born at Great Wycomb in Buckinghamshire. From Eton school, in the year 1528, he removed to King's college. Cambridge, where he took the degree of bachelor of arts. He also studied some time at Oxford; afterwards he married, was presented to a living, and became a zealous reformer. Upon Queen Mary's accession he left his cure and retired into the north of England; where he maintained his wife and himself by teaching a school, and practising physic. Queen Elizabeth ascending the throne, he went to London, where he acquired great reputation by reading the divinity lecture at St Paul's, and in July 1560 was consecrated bishop of Exeter. He was created doctor of divinity at Oxford in November 1561. He died on the 15th of April 1570, and was buried at Exeter in the cathedral. He wrote, 1. The Poor Man's Library, 2 vols. fol. Lond. 1571. These volumes contain twelve lectures on the first epistle of St Peter, read at St Paul's. 2. A Hebrew Grammar. Whether it was ever published is uncertain. He translated the Pentateuch, in the version of the Bible which was undertaken by Queen Elizabeth's command.

ALLEY, in *Gardening*, a straight parallel walk, bounded on both sides with trees, shrubs, &c. and usually covered with gravel or turf.

ALLEY, among builders, denotes a narrow passage leading from one place to another.

ALLEY, in *Perspective*, that which, in order to have

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a greater appearance of length, is made wider at the entrance than at the termination.

ALLEY, in the new husbandry, implies the vacant space between the outermost row of corn on one bed and the nearest row to it on the next parallel bed; and it is usually about four feet in breadth, exclusive of the partitions between the rows of corn in the beds. The first hoeing of wheat is performed in the beginning of winter, and the earth is ploughed away from the rows into the intervals, which forms small ridges in the middle between the double rows. The second hoeing is in the spring, which turns it back to the rows, leaving a furrow in the middle of the alley. The third hoeing is from the rows, after the wheat has blossomed: this turns the earth into the intervals, forming small ridges there, as at the first hoeing. The fourth hoeing returns the earth to the ridges, which is performed a month or more after the third hoeing. This commonly finishes the horse-hoeings, if the land is in good heart; otherwise one or two more hoeings are necessary.

ALLEYN, EDWARD, a celebrated English actor in the reigns of Queen Elizabeth and King James, and founder of the college of Dulwich in Surry, was born at London in the parish of St Botolph, Sept. 1. 1566, as appears from a memorandum of his own writing. Dr Fuller says, that he was bred a stage-player; and that his father would have given him a liberal education, but that he was not turned for a serious course of life. He was, however, a youth of an excellent capacity, a cheerful temper, a tenacious memory, a sweet elocution, and in his person of a stately port and aspect: all which advantages might well induce a young man to take to the theatrical profession. By several authorities we find he must have been on the stage some time before 1592; for at this time he was in high favour with the town, and greatly applauded by the best judges, particularly by Ben Johnson.

Haywood, in his prologue to Marlow's Jew of Malta, calls him Proteus for shapes, and Roscius for a tongue. He usually played the capital parts, and was one of the original actors in Shakespeare's plays; in some of Ben Johnson's he was also a principal performer: but what characters he personated in either of these poets, it is difficult now to determine. This is owing to the inaccuracy of their editors, who did not print the names of the players opposite to the characters they performed, as the modern custom is; but gave one general list of actors to the whole set of plays, as in the old folio edition of Shakespeare; or divided one from the other, setting the dramatis personæ before the plays, and the catalogue of performers after them, as in Johnson's.

It may appear surprising how one of Mr Alley's profession should be enabled to erect such an edifice as Dulwich college, and liberally endow it for the maintenance of so many persons. But it must be observed that he had some paternal fortune, which, though small, might lay a foundation for his future affluence; and it is to be presumed, that the profits he received from acting, to one of his provident and managing disposition and one who by his excellence in playing drew after him such crowds of spectators, must have considerably improved his fortune: besides, he was not only an actor, but master of a playhouse built at his

own expence, by which he is said to have amassed considerable wealth. He was also keeper of the king's wild beasts, or master of the royal bear-garden, which was frequented by vast crowds of spectators; and the profits arising from these sports are said to have amounted to 500l. per annum. He was thrice married; and the portions of his two first wives, they leaving him no issue to inherit, might probably contribute to this benefaction. Such kind of donations have been frequently thought to proceed more from vanity and ostentation than real piety; but this of Mr Alley's has been ascribed to a very singular cause, for the devil has been said to be the first promoter of it. Mr Aubrey mentions a tradition, "that Mr Alley's playing a demon, with six others, in one of Shakespeare's plays, was in the midst of the play, surprised by an apparition of the devil; which so worked on his fancy, that he made a vow, which he performed by building Dulwich college. He began the foundation of this college, under the direction of Inigo Jones, in 1614; and the buildings, gardens, &c. were finished in 1617, in which he is said to have expended about 10,000l. After the college was built, he met with some difficulty in obtaining a charter for settling his lands in mortmain; for he proposed to endow it with 800l. per annum, for the maintenance of one master, one warden, and four fellows, three whereof were to be clergymen, and the fourth a skilful organist; also six poor men and as many women, besides twelve poor boys to be educated till the age of fourteen or sixteen, and then put out to some trade or calling. The obstruction he met with arose from the lord chancellor Bacon, who wished King James to settle part of those lands for support of two academical lectures; and he wrote a letter to the Marquis of Buckingham, dated August 18. 1618, entreating him to use his interest with his Majesty for that purpose. Mr Alley's solicitation was however at last complied with, and he obtained the royal license, giving him full power to lay his foundation, by his Majesty's letters patent, bearing date the 21st of June 1619; by virtue whereof he did, in the chapel at the said new hospital at Dulwich, called *The College of God's Gift*, on the 13th of September following, publicly read and publish a quadripartite writing in parchment, whereby he created and established the said college; he then subscribed it with his name, and fixed his seal to several parts thereof, in presence of several honourable persons, and ordered copies of the writings to four different parishes. He was himself the first master of his college; so that to make use of the words of Mr Haywood, one of his contemporaries, "He was so mingled with humility and charity, that he became his own pensioner, humbly submitting himself to that proportion of diet and clothes which he had bestowed on others." We have no reason to think he ever repented of this distribution of his substance; but, on the contrary, that he was entirely satisfied, as appears from the following memorial in his own writing, found amongst his papers: May 26. 1620.—My wife and I acknowledged the fine at the common pleas bar, of all our lands to the college: blessed be God that he has given us life to do it." His wife died in the year 1623; and about two years afterwards he married Constance Kinchtoe, who survived him, and received

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remarkable proofs of his affection, if at least we may judge of it by his will, wherein he left her considerably. He died Nov. 25. 1626, in the 61st year of his age, and was buried in the chapel of his new college, where there is a tomb-stone over his grave, with an inscription. His original diary is also there preserved.

The subjoining anecdote is entertaining in itself, and shows the high esteem in which Mr Alleyn was held as an actor: "Edward Alleyn, the Garrick of Shakespeare's time, had been on the most friendly footing with our poet, as well as Ben Johnson. They used frequently to spend their evenings together at the sign of the Globe, somewhere near Blackfriars, where the playhouse then was. The world need not be told, that the convivial hours of such a triumvirate must be pleasing as well as profitable, and may be said to be such pleasures as might bear the reflections of the morning. In consequence of one of these meetings, the following letter was written by G. Peele, a fellow of Christ-church college, Oxford, and a dramatic poet, who belonged to the Club, to one Marle, an intimate of his:

' Friend Marle.

' I must desyr that my syster byr watch, and the cookieke book you promysed, may be sente bye the man.—I never longed for thy company more than last night: we were all very merrye at the Globe, when Ned Alleyn did not scruple to asseyrme pleasauntly to thy Friende Will, that he had stolen his speech about thee Qualities of an actor's excellencye in Hamlet hys Tragedye, from conversations manyfold which had passed betwene them, and opinyons given by Alleyn touching the snbjecte.—Shakespeare did not take this talke in good sorte; but Johnson put an ende to the strife with wittilye remarkinge, *This affaire needeth no Contentione; you stole it from Ned, no doubt; do not marvel: Have you not seen him act tymes out of number?*—Believe me most syncerilie, yours, G. Peele.'

ALLIA, a river of Italy, in the Sabine territory, which running down a very deep channel from the mountains of Crustumium, mixes with the Tiber 40 miles from Rome; famous for the great slaughter of the Romans, by the Gauls under Brennus, when 40,000 Romans were killed or put to flight; hence *Alliensis dies*, an unlucky day (Virgil, Ovid, Lucan). Our ancestors, says Cicero, deemed the day of the fight of *Allia* more fatal than that of taking the city.

ALLIANCE, in the *Civil and Canon Law*, the relation contracted between two persons or two families by marriage.

ALLIANCE is also used for a treaty entered into by sovereign princes and states, for their mutual safety and defence.—In this sense, alliances may be distinguished into such as are offensive, whereby the contracting parties oblige themselves jointly to attack some other power; and into defensive ones, whereby they bind themselves to stand by and defend each other in case they are attacked by others. Alliance with the ancient Romans, though a sort of servitude, was much coveted. Ariarathes, we are told by Polybius, offered a sacrifice to the gods by way of thanksgiving for having obtained this alliance. The reason was,

that thenceforward people were sure not to receive any injuries except from them. There were different sorts of allies: some only united to them by a participation of the privileges of Romans, as the Latini and Hernici; others by their very foundation, as the colonies; others by the benefactions they received from them, as Masinissa, Eumenes, and Attalus, who owed their kingdoms to Rome; others by free treaties, which last by a long alliance became subjects, as the kings of Bithynia, Cappadocia, Egypt, and most of the cities of Greece: Lastly, others by compulsive treaties, and the law of subjection, as Philip and Antiochus. For they never granted peace to an enemy, without making an alliance with him; that is, they never subdued any people without using it as a means of subduing others.

The forms or ceremonies of alliances have been various in different ages and countries. Among us, signing and swearing, sometimes at the altar, are the chief; anciently eating and drinking together, chiefly offering sacrifices together, were the customary rite of ratifying an alliance. Among the Jews and Chaldeans, heifers or calves, among the Greeks bulls or goats, and among the Romans hogs, were sacrificed on this occasion. Among the ancient Arabs, alliances were confirmed by drawing blood out of the palms of the hands of the two contracting princes with a sharp stone, dipping therein a piece of their garments, and therewith smearing seven stones, at the same time invoking the gods Vrotalt and Alilat, i. e. according to Herodotus, Bacchus and Uranus. Among the people of Colchis, the confirmation of alliances was said to be effected by one of the princes offering his wife's breasts to the other to suck, which he was obliged to do till there issued blood.

ALLIANCE, in a figurative sense, is applied to any kind of union or connection; thus we say, there is an alliance between the church and state.

ALLIARA. See ERYSIMUM, BOTANY *Index*.

ALLIER, in *Geography*, a river of France, which gives name to a department, has its source near Chateau Neuf de Randon, in the department of Lozere, and joins the Loire near Nevers.

ALLIER, a department of France, formerly the province of Bourbonnois, is bounded on the north by the departments of Saone and Loire, Nièvre and Cher; on the east by those of Saone and Loire and the Loire, on the south by those of the Loire, Puy de Dome, and Creuse; and on the west by those of Creuse and Cher. It contains 1,454,341 square acres; the number of inhabitants is about 265,266; and it is divided into four communal districts. The principal town is Moulins.

ALLIGATI, in Roman antiquity, the basest kind of slaves, who were usually kept fettered. The Romans had three degrees, or orders, of slaves or servants; the first employed in the management of their estates; the second in the menial or lower functions of the family: the third called *alligati*, above mentioned.

ALLIGATION, the name of a method of solving all questions that relate to the mixture of one ingredient with another. Though writers on arithmetic generally make alligation a branch of that science; yet, as it is plainly nothing more than an application of the common properties of numbers, in order to solve a few questions

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Alligation. questions that occur in particular branches of business, we choose rather to keep it distinct from the science of arithmetic.

Alligation is generally divided in *medial* and *alternate*.

ALLIGATION Medial, from the rates and quantities of the simples given, discovers the rate of the mixture.

Rule. As the total quantity of the simples,
To their price or value;
So any quantity of the mixture,
To the rate.

Examp. A grocer mixeth 30lb. of currants, at 4d. per lb. with 10lb. of other currants, at 6d. per lb.: What is the value of 1lb. of the mixture? *Ans.* 4½d.

lb.	d.	d.
30,	at 4	amounts to 120
10,	at 6	60
40		180
	lb.	d.
	lb.	d.

If 40 : 180 :: 1 : 4½.

Note 1. When the quantity of each simple is the same, the rate of the mixture is readily found by adding the rates of the simples, and dividing their sum by the number of simples. Thus,

Suppose a grocer mixes several sorts of sugar, and of each an equal quantity, viz. at 50s. at 54s. and at 60s. per cwt. the rate of the mixture will be 54s. 8d. per cwt.; for

$$50 + 54 + 60 = 164, \text{ and } 3)164(54 \text{ } 8$$

Note 2. If it be required to increase or diminish the quantity of the mixture, say, As the sum of the given quantities of the simples, to the several quantities given; so the quantity of the mixture proposed, to the quantities of the simples sought.

Note 3. If it be required to know how much of each simple is an assigned portion of the mixture, say, As the quantity of the mixture, to the several quantities of the simples given; so the quantity of the assigned portion, to the quantities of the simples sought. Thus.

Suppose a grocer mixes 10lb. of raisins with 30lb. of almonds and 40lb. of currants, and it be demanded how many ounces of each sort are found in every pound, or in every 16 ounces of the mixture, say,

oz.	
80 : 10 :: 16 : 2 raisins.	
80 : 30 :: 16 : 6 almonds.	
80 : 40 :: 16 : 8 currants.	

Proof 16

Note 4. If the rates of two simples, with the total value and total quantity of the mixture, be given, the quantity of each simple may be found as follows: viz. Multiply the lesser rate into the total quantity, subtract the product from the total value, and the remainder will be equal to the product of the excess of the higher rate above the lower, multiplied into the quantity of the higher-priced simple; and consequently the

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said remainder, divided by the difference of the rates, will quote the said quantity. Thus,

Suppose a grocer has a mixture of 400lb. weight, that cost him 7l. 10s. consisting of raisins at 4d. per lb. and almonds at 6d. how many pounds of almonds were in the mixture?

L. s. d.	lb.	Rates.	L. d.
7 10 = 1800	400	6d.	2 10
1600	4	4d.	5 0
	1600d.	2d.	
2)200(100lb. of almonds at 6d. is			
And 300lb. of raisins at 4d. is			
Total 400			Proof 7 10

ALLIGATION Alternate, being the converse of alligation medial, from the rates of the simples, and rate of the mixture given, finds the quantities of the simples.

Rules. I. Place the rate of the mixture on the left side of a brace, as the root; and on the right side of the brace set the rates of the several simples, under one another, as the branches. II. Link or alligate the branches, so as one greater and another less than the root may be linked or yoked together. III. Set the difference betwixt the root and the several branches right against their respective yoke-fellows. These alternate differences are the quantities required. **Note 1.** If any branch happen to have two or more yoke-fellows, the difference betwixt the root and these yoke-fellows must be placed right against the said branch, one after another, and added into one sum. 2. In some questions, the branches may be alligated more ways than one: and a question will always admit of so many answers as there are different ways of linking the branches.

Alligation alternate admits of three varieties, viz.

1. The question may be unlimited, with respect both to the quantity of the simples and that of the mixture.
2. The question may be limited to a certain quantity of one or more of the simples.
3. The question may be limited to a certain quantity of the mixture.

Variety I. When the question is unlimited, with respect both to the quantity of the simples, and that of the mixture, this is called *Alligation Simple*.

Examp. A grocer would mix sugars at 5d. 7d. and 10d. per lb. so as to sell the mixture or compound at 8d. per lb.: What quantity of each must he take?

	lb.
8 { 5 7 10 } 2 2 2 4	

Here the rate of the mixture 8 is placed on the left side of the brace as the root; and on the right side of the same brace are set the rates of the several simples, viz. 5, 7, 10, under one another, as the branches; according to Rule I.

The branch 10 being greater than the root, is alligated or linked with 7 and 5, both these being less than the root; as directed in Rule II.

The difference between the root 8 and the branch 5, viz. 3, is set right against this branch's yoke-fellow 10. The difference between 8 and 7 is likewise set right

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Alligation. against the yoke-fellow 10. And the difference betwixt 8 and 10, viz. 2, is set right against the two yoke-fellows 7 and 5; as prescribed by Rule III.

As the branch 10 has two differences on the right, viz. 3 and 1, they are added; and the answer to the question is, that 2lb. at 5d. 2lb. at 7d. and 4lb. at 10d. will make the mixture required.

The truth and reason of the rules will appear by considering, that whatever is lost upon any one branch is gained upon its yoke-fellow. Thus in the above example, by selling 4lb. of 10d. sugar at 8d. per lb. there is 8d. lost: but the like sum is gained upon its two yoke-fellows; for by selling 2lb. of 5d. sugar at 8d. per lb. there is 6d. gained; and by selling 2lb. of 7d. sugar at 8d. there is 2d. gained; and 6d. and 2d. make 8d.

Hence it follows, that the rate of the mixture must always be mean or middle with respect to the rates of the simples; that is, it must be less than the greatest, and greater than the least; otherwise a solution would be impossible. And the price of the total quantity mixed, computed at the rate of the mixture, will always be equal to the sum of the prices of the several quantities cast up at the respective rates of the simple.

Variety II. When the question is limited to a certain quantity of one or more of the simples, this is called *Alligation Partial*.

If the quantity of one of the simples only be limited, alligate the branches, and take their differences, as if there had been no such limitation; and then work by the following proportion:

As the difference right against the rate of the simple,
whose quantity is given,
To the other differences respectively;
So the quantity given,
To the several quantities sought.

Examp. A distiller would, with 40 gallons of brandy at 12s per gallon, mix rum at 7s. per gallon, and gin at 4s per gallon: How much of the rum and gin must he take, to sell the mixture at 8s. per gallon?

$$\begin{array}{r} \text{Gal.} \\ 8 \left\{ \begin{array}{l} 12 \text{ } 14, \\ 7 \text{ } 4 \\ 4 \text{ } 4 \end{array} \right. \left| \begin{array}{l} 5 \\ 4 \\ 4 \end{array} \right. \left\{ \begin{array}{l} 40 \text{ of brandy.} \\ 32 \text{ of rum.} \\ 32 \text{ of gin.} \end{array} \right. \end{array} \quad \text{Ans.}$$

The operation gives for answer, 5 gallons of brandy, 4 of rum, and 4 of gin. But the question limits the quantity of brandy to 40 gallons; therefore say,

If 5 : 4 :: 40 : 32

The quantity of gin, by the operation, being also 4, the proportion needs not be repeated.

Variety III. When the question is limited to a certain quantity of the mixture, this is called *Alligation Total*.

After linking the branches, and taking the differences, work by the proportion following:

As the sum of the differences,
To each particular difference;
So the given total of the mixture,
To the respective quantities required.

Examp. A vintner hath wine at 3s. per gallon, and

would mix it with water, so as to make a composition of 144 gallons, worth 2s. 6d. per gallon: How much wine, and how much water, must he take?

$$\begin{array}{r} \text{Gal.} \\ 30 \left\{ \begin{array}{l} 36 \\ 0 \end{array} \right. \left| \begin{array}{l} 30 \\ 6 \end{array} \right. \left\{ \begin{array}{l} 120 \text{ of wine} \\ 24 \text{ of water.} \end{array} \right. \end{array} \quad \text{Ans.}$$

$$\begin{array}{r} 36 \\ 120 \times 36 = 4320 \\ 24 \times 0 = 0 \\ \hline \end{array}$$

Proof 144)4320(30

As 36 : 30 :: 144 : 120

As 36 : 6 :: 144 : 24.

There being here only two simples, and the total of the mixture limited, the question admits but of one answer.

ALLIGATOR, in *Zoology*, a synonyme of the *lacerta crocodilus*. See *LACERTA*.

ALLIGATOR Pear. See *LAURUS*, *BOTANY Index*.

ALLIONIA. See *BOTANY Index*.

ALLIOTH, a star in the tail of the Greater Bear, much used for finding the latitude at sea.

ALLITERATION, an ornament of language chiefly used in poetry, and consisting in the repetition of the same letter at certain intervals. We do not remember to have ever seen any satisfactory account of alliteration in the writings of the critics. They seem to have passed it over in contemptuous silence; either as a false refinement or as a mere trifle. It perhaps deserves a better fate. Many chapters have been composed on quantity, on the expression resulting from different arrangements of long and short syllables, and on the powers of pauses as they are variously placed, without a word of alliteration. This is the more extraordinary, as one should think it impossible for any man to examine minutely, and, as it were, dissect a number of verses, without perceiving the vast abundance of this ornament. It is as if an anatomist should publish a complete table of the arteries in the human body, and affect never to have seen a vein or a nerve: for it may be affirmed, with small danger of mistake, that if you examine any number of verses, remarkable either for sweetness or for energy, they will be found in some degree alliterative. We do not pretend to say, that the sweetness and energy of versification depends chiefly on this circumstance, yet we cannot help believing that it may claim some share: for it is a constant appearance, as far as we have ever observed, that the poets whose fame is highest for versification, have been attentive to alliteration.

The very trifling appearance of the ornament itself, upon a superficial view, and the frequent abuse of it, are circumstances indeed which give no encouragement to a serious inquiry into its nature and operation. How common is it for writers, who affect to be comic, when in want of other means for raising a smile, to use affected alliteration with success? But, in the fine arts, no beauty or grace is beyond the power of ridicule. The noblest attitudes in painting have been rendered laughable by caricatura. St Paul preaching at Athens, in the design of Raphael, appears elegant, noble, and in some degree awful. The same apostle, represented by Hogarth in nearly the same attitude, pleading before

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Alliteration.

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fore the governor Felix, seems altogether ridiculous. So the language and versification of Milton in the *Paradise Lost* appear only proper for the most elevated subjects. In the *Splendid Shilling* of Philips, they appear equally proper for the lowest. So fares it also with alliteration. Nor ought we to be mortified at the discovery, that much of the delight afforded by versification arises from a cause so pitiful as the repetition of the same letter twice, or oftener, on the accented parts of a verse; for there are many other causes of pleasure, which, when thus detected and taken to pieces, seem equally contemptible.

We apprehend the principal operation of this ornament to be quite mechanical. It is easier for the organs of speech to resume, at short intervals, one certain conformation, than to throw themselves into a number of different ones, unconnected and discordant. For example, a succession of labials, interspersed at regular distances with dentals and gutturals, will be more easily pronounced than the succession of all the three at random. Sounds of which the articulation is easiest, are most completely in the power of the speaker. He can pronounce them slowly or rapidly, softly or with force, at pleasure. In this we imagine the power and advantage of alliteration are founded; for we would not lay any stress on the pleasure which can result to the ear from the repetition of the same letter. It has been compared to the frequent returns of the key-note in a musical strain; but that analogy is extremely faint. The ear, we presume, can be pleased with alliteration only in so far as it contributes to the superior easiness of recitation; for what is recited with ease must be heard with pleasure.

These remarks might be confirmed and illustrated by numberless passages from the best poets. Some few lines will suffice, taken from Gray, who seems to have paid particular attention to this grace. He professed to have learned his versification from Dryden, as Dryden did from Spenser: and these three abound in alliteration above all the English poets. We choose Gray for another reason, in proof of what we mentioned before, that alliteration contributes not only to the *sweetness*, but also to the *energy*, of versification; for he uses it chiefly when he aims at strength and boldness. In the *Sister Odes* (as Dr Johnson styles them), almost every strophe commences and concludes with an alliterative line. The poet, we supposed, wished to begin with force, and end with dignity.

"Ruin seize thee, ruthless king."
 "To high-born Hoel's harp, or soft Llewellyn's lay."
 "Weave the warp, and weave the woof."
 "Stamp we our vengeance deep, and ratify his doom."
 "Regardless of the sweeping whirlwind's sway."
 "That hush'd in grim repose, expects his evening prey."

It must be observed here, that we hold a verse alliterative which has a letter repeated on its accented parts, although those parts do not begin words; the repeated letter bearing a strong analogy to the bars in a musical phrase. Gray seems to have had a particular liking to these sorts of balanced verses which divide equally, and of which the opposite sides have an alliterative resemblance.

"Eyes that glow and fangs that grin."

"Thoughts that breathe, and words that burn."

"Hauberk crash, and helmet ring."

Alliteration
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Allix.

All these lines appear to us to have a force and energy, arising from alliteration, which renders them easy to be recited; or, if the reader pleases, *mouthed*. For the same reason the following passage appears sad and solemn, by the repetition of the labial liquid.

"Mountains, ye mourn in vain,"

"Modred, whose magic song"—&c.

If alliteration thus contributes to enforce the expression of a poetical sentiment, its advantages in poetry must be considerable. It is not, therefore, unworthy a poet's regard in the act of composition. If two words offer of equal propriety, the one alliterative, the other not, we think the first ought to be chosen. We would compare this to the practice of fuguing in music. A composer who aims at expression will not hunt after fugues; but if they offer, if they seem to arise spontaneously from the subject, he will not reject them. So a good poet ought not to select an epithet merely for beginning with a certain letter, unless it suit his purpose well in every other respect; for the beauty of alliteration, when happy, is not greater than its deformity when affected. A couplet from Pope will exemplify both; the first line being bad, and the second good:

"Eternal beauties grace the shining scene,

"Fields ever fresh, and groves for ever green."

ALLIUM (from *alio*, "to avoid or shun," because many shun the smell of it), GARLIC. See BOTANY Index.

ALLIX, PETER, a French Protestant divine, was born at Alençon in France, in the year 1641. He became a learned divine of the English church, and a strenuous defender of the Protestant faith. At the time when the edict of Nantes tolerated and protected the Protestants of France, he entered upon his clerical profession, and remained minister of Rouen until the thirty-fifth year of his age. In this period he wrote several pieces upon the controversy between the Papists and the Protestants, which obtained him great fame among his own party. He removed to Charenton in the vicinity of Paris, which was the principal church among the reformed, and frequented by persons of the first rank in France, who professed the Protestant faith. Here Allix preached a course of excellent sermons in defence of the Protestant religion, some of which were afterwards printed in Holland, and added to his increasing fame. The chief object of these sermons was to repel the attack of the bishop of Meaux, the most ingenious and able opponent of the Reformation at that time. The unwise revocation of the edict of Nantes drove Allix and many others to seek refuge in England. Three years after his arrival in England, he had made himself so perfectly master of the English language as to be able to write very correctly a "Defence of the Christian Religion." This work he dedicated to James II. in testimony of gratitude for his kind reception of the distressed refugees of France. In justice to the memory of James,

Allix
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Alloa.

and as a specimen of the talents of Allix, it may be proper to give an extract from this curious dedication. —“As your majesty continues still to give such illustrious instances of your clemency and royal protection to those of our nation; so I confess, Sir, I thought myself under an obligation to lay hold upon this opportunity of publishing what all those who find so sure a protection in your majesty's dominions feel and think as much as myself upon these new testimonies of your royal bounty. When your majesty had taken us into your particular care, and had granted us several privileges, and so made us sharers in all the advantages which those who live under your government enjoy; your majesty did yet something more, and inspired all your subjects with the same compassion towards us, with which your royal breast was already touched. You saw our miseries, and resolved to give us ease; and this generous design was executed, and your royal clemency diffused in the hearts of all your subjects. The whole world, Sir, which has received upon all its coasts some remainders of our shipwreck, is filled with admiration of the unexampled effects of your majesty's clemency. I could wish, Sir, that this work which I now present to your majesty might be so happy as to pass to posterity with this character of our acknowledgment, and that it might stand as a faithful record for ever to perpetuate the memory of that lively sense of your bounty which is imprinted on all our hearts.”

Not long after his arrival in England, he was honoured with the title of doctor of divinity, and also received the more substantial honour of being appointed treasurer of the church of Salisbury. Allix still maintained the station of a champion for the Protestant cause, and in opposition to the bishop of Meaux proved that the charge of heresy justly belonged to the Papists, and not to their opponents, because they had introduced new doctrines into the church.

After having with much industry and learning exercised his talents in defence of Protestantism, he employed his pen to support the doctrine of the Trinity against the Unitarians, who contended that the idea of Christ's divinity could be traced up no higher than the time of Justin Martyr. With a great display of erudition, he attempted to prove that the Trinitarian doctrine was believed by the Jewish church. But the reputation which he had acquired for learning and ability was somewhat diminished, by the ridicule which he brought upon himself in attempting to fix the precise time of Christ's second coming to the year 1720, or at the very latest, to the year 1736. He died at London in the year 1717, after his studious life had been protracted to the length of 76 years. He left behind him numerous proofs of his great talents, extensive learning, uncommon industry, and zealous attachment to the doctrines of the church of England. (*Gen. Biog.*)

ALLOA, or ALLOWAY, a sea-port town in Scotland, seated on the Forth, about 20 miles higher up the river than Leith, and five miles east of Stirling. It is a populous place; has two market days in the week; and is remarkable for its fine castle, the seat of Mr Erskine of Mar, and for the coal mines near it. The harbour is extremely commodious, with great depth of water; and vessels are expeditiously loaded with coals from the pits by an uncommon waggon-way, on which one horse draws with ease three waggons at

once, each waggon containing a ton and a half. An excellent dry dock has also lately been erected here, capable of receiving ships of the greatest burden. There is likewise a large glass house for blowing bottles, of which vessels are supplied with any quantity upon the shortest notice.

The tower and lands of Alloa were exchanged by David II. king of Scots, *anno* 1365, with Thomas Lord Erskine, for the lands and estate of Strathgartney in Perthshire; and since that time the castle of Alloa has been the favourite residence of the family of Mar. The situation is uncommonly beautiful. The gardens here were the first that were laid out on a great scale in Scotland; and, with the advice of La Nautre, were indebted to the taste of John the late earl of Mar, who began to plant them in the year 1706. They contain about forty acres, in which there is some very fine timber, near a century old.

The tower of Alloa is 89 feet in height, with walls of 11 feet in thickness; and was built in the end of the 13th century. In this residence of the family of Erskine many of the Scottish princes received their education, having been for more than two centuries the wards of the Lords Erskine and Earls of Mar; who held generally the castle of Stirling, and frequently the three principal fortresses of the kingdom, Edinburgh, Stirling, and Dumbarton. The last heir of the Scottish monarchy who was nurtured there was Henry prince of Wales; whose cradle, golf-clubs, and other infantine and youthful remains, are preserved by the heir of the earls of Mar, in remembrance of that spirited and promising prince; of whom Dr Birch has preserved several anecdotes, connected with the Erskines and his residence at Alloa. Among other remains of antiquity preserved at Alloa, in remembrance of the confidence and affection which subsisted always betwixt the Stuarts and the Erskines, is the private signet of the unfortunate Mary, which she gave to the regent Mar, after she was obliged by the treaty of Edinburgh to desist from wearing the arms of England in the first quarter; the child's chair of James VI. her son; and the festive chair of Thomas Lord Erskine the second earl of Mar of the name, with the fashionable grace carved on it, *Soli Deo Honor et Gloria*.

ALLOBROGES, (Inscription, Livy, Velleius, Florus); from *Allobrox* (Horace): a people of Gallia Narbonensis, situated between the rivers Isara and Rhodanus, and the Lacus Lemanus; commended by Cicero for their fidelity; but reproached by Horace on account of their fondness for novelty.

Novisque rebus infidelis Allobrox. Epod. 16.

ALLOCATION denotes the admitting or allowing of an article of an account, especially in the exchequer. Hence

ALLOCATIONE Facienda, is a writ directed to the lord treasurer, or barons of the exchequer, commanding them to allow an accountant such sums as he has lawfully expended in the execution of his office.

ALLOCUTIO, an oration or speech of a general addressed to his soldiers, to animate them to fight, to appease sedition, or to keep them to their duty. A mound of earth was raised upon the occasion, as it were a kind of a tribunal of turf. From this the general pronounced his harangue to the army, which was ranged

Alloa
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Allocutio.

Allodium
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Allush.

ged in several squadrons round him, with their captains at their head. When the time and circumstances would not admit of a formal harangue, the general went through the ranks, and called each by his name, putting them in mind of their courage upon former occasions, mentioning the victories they had won, and making a promise of plunder.

ALLODIUM, or **ALLEUD**, denotes lands which are the absolute property of their owner, without being obliged to pay any service or acknowledgment whatever to a superior lord. See **FEE** and **FEODAL System**.

ALLOPHYLLUS, in *Botany*. See **BOTANY Index**.

ALLOTING, or **ALLOTMENT** of *Goods*, in matters of commerce, is when a ship's cargo is divided into several parts, bought by divers persons, whose names are written on as many pieces of paper, which are applied by an indifferent person to the several lots or parcels; by which means the goods are divided without partiality, every man having the parcel which the lot with his name appropriates.

ALLOWAY CREEK, in Salem county, New Jersey, empties into the Delaware. It is navigable 16 miles, interrupted, however, by several draw-bridges.

ALLOY, or **ALLAY**, properly signifies a proportion of a baser metal mixed with a finer one. The alloy of gold is estimated by carats, that of silver by pennyweights. In different nations different proportions of alloy are used; whence their moneys are said to be of different degrees of fineness or baseness, and are valued accordingly in foreign exchanges. The chief reasons alleged for the alloying of coin are: 1. The mixture of the metals, which, when smelted from the mine, are not perfectly pure. 2. The saving the expence it must otherwise cost if they were to be refined. 3. The necessity of rendering them harder, by mixing some parts of other metals with them, to prevent the diminution of weight by wearing in passing from hand to hand. 4. The melting of foreign gold or coin which is alloyed. 5. The charges of coinage, which must be made good by the profit arising from the money coined. 6. and lastly, The duty belonging to the sovereign, on account of the power he has to cause money to be coined in his dominions.

In a more general sense, the word is employed in chemistry to signify the union of different metallic matters.—As an infinity of different combinations may be made according to the nature, the number, and the proportions of the metallic matters capable of being alloyed, we shall not here enter into the detail of the particular alloys, all which are not yet nearly known. Those which are used, as *Bronze, Tombac, Brass, White Copper*, &c. may be found in the articles **CHEMISTRY**, and what is known concerning other alloys will be treated of along with the metals in the same article. See **CHEMISTRY Index**.

ALLUM. See **ALUM**.

ALLUMINOR, from the French *allumer*, "to lighten," is used for one who coloureth or painteth upon paper or parchment; and the reason is, because he gives light and ornament by his colours to the letters or other figures. Such ornaments are styled *illuminations*. The word is used in stat. 1. R. III. cap. 9. But now such a person is called a *limner*.

ALLUSH, in *Ancient Geography*. The Israelites

being in the wilderness of Shur, departed from Dophkah, and went to Allush, from whence they proceeded to Rephidim; Num. xxxiii. 13, 14. Eusebius and St Jerome fix Allush in Idumea, about Gabala or Petra, the capital of Arabia Petraea. In the accounts of the empire, it is situated in the third Palestine; and by Ptolemy, among the cities of Idumæa.

ALLUSION, in *Rhetoric*, a figure by which something is applied to, or understood of, another, on account of some similitude between them.

ALLUVION, in *Law*, denotes the gradual increase of land along the sea-shore, or on banks of rivers.

ALLY, in matters of polity, a sovereign prince or state that has entered into alliance with others. See **ALLIANCE**.

ALMACANTARS. See **ALMUCANTARS**.

ALMACARRON, a sea-port town of Spain, in the province of Murcia, at the mouth of the river Guadalautin. It is about twenty miles west of Carthage, and is remarkable for the prodigious quantity of alum found in its territory. W. Long. 1. 15. N. Lat. 37. 40.

ALMADEN, a town of Spain, in the province of La Mancha, in the kingdom of Castile, situated upon the top of a mountain, where are the most ancient as well as the richest silver mines in Europe.

ALMADIE, a kind of canoe or small vessel, about four fathoms long, commonly made of bark, and used by the negroes of Africa.

ALMADIE is also the name of a kind of long boats, fitted out at Calicut, which are eighty feet in length, and six or seven in breadth. They are exceedingly swift, and are otherwise called *cathuri*.

ALMAGEST, in matters of literature, is particularly used for a collection or book composed by Ptolemy, containing various problems of the ancients both in geometry and astronomy.

ALMAGEST is also the title of other collections of this kind. Thus, Riccioli has published a book of astronomy, which he calls the *New Almagest*; and Plukenet, a book which he calls *Almagestum Botanicum*.

ALMAGRA, a fine deep red ochre, with some admixture of purple, very heavy, and of a dense yet friable structure, and rough dusty surface. It adheres very firmly to the tongue, melts freely and easily in the mouth, is of an austere and strongly astringent taste, and stains the skin in touching. It is the *Sil Atticum* of the ancients; it ferments very violently with acid menstrua; by which single quality, it is sufficiently distinguished from the *Sil Syricum*, to which it has in many respects a great affinity. It is found in immense quantities in many parts of Spain; and in Andalusia there are in a manner whole mountains of it. It is used in painting, and in medicine as an astringent.

ALMAGRO, a fortress of Spain, the capital of one of the districts of La Mancha. It was built by the archbishop Roderic of Toledo, who finished it in 1214, and put a considerable garrison into it to restrain the incursions of the Moors. This was hardly done, when the fortress was besieged by an army of 5000 horse and foot, under the command of a Moorish officer of great reputation; but the prelate, its founder, took care to supply those within with such plenty of necessaries, that at length the enemy found themselves obliged to raise the siege and retire with great loss.

ALMAGRO, *Diego de*, a Spanish commander, was

Allusie
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Almagro.

Almagro. of such obscure birth and mean parentage that he derived his name from the village where he was born, in 1463. Deprived of the means of early instruction, he could neither read nor write, but nevertheless, in consequence of his improvements in the military art, he formed an association with Pizarro and de Luque, for the purpose of discoveries and conquest upon the Peruvian coast. The governor of Panama having sanctioned their enterprise, they devoted their united exertions to that undertaking. Pizarro directed the conquest, and Almagro was appointed to conduct the supplies, provisions, and reinforcements. In the two first unsuccessful attempts, he performed this office with persevering fidelity and uncommon activity. His perseverance was followed with complete success; for they at last discovered the coast of Peru, and landed at Tumbez, distinguished by its temple and palace of the incas or sovereigns, and situated about three degrees south of the line. Pizarro was sent over to Spain to solicit farther powers, after the three adventurers had previously adjusted their future preferments, and agreed that Pizarro should be governor, Almagro lieutenant-governor, and Luque bishop. In this negotiation Pizarro obtained the clerical dignity for Luque; but chiefly concerned about his own interest, he neglected the preferment of Almagro. On his return, Almagro was so enraged, that he refused to act with such a perfidious companion, and resolved to form a new association. Pizarro for the present artfully endeavoured to avert the indignation of Almagro, and gradually soothed the rage and disappointment of the soldier. The union was renewed upon the former terms; and it was solemnly stipulated that a common expence and a common advantage should take place.

In February 1531, leaving Almagro at Panama, to supply provisions and reinforcements, Pizarro set sail for Peru. He attacked a principal settlement of the natives, in the province of Coaque, obtained immense spoil, and made such ample remittances to Almagro, as enabled him to complete his reinforcement, and in the close of the year 1532, he arrived at St Michael with a body of men, which nearly doubled the number of those which Pizarro had along with him. The Spaniards about this time took captive the unfortunate Inca Atahualpa; and after they had received an immense sum for his ransom, they barbarously put him to death. Pizarro sailed for Spain with the news of their success, and with remittances to a great amount; and consequently Almagro gained that elevated station he so long and eagerly desired. But no sooner had Almagro received the intelligence of his promotion by the royal grant, than he attempted to seize Cuzco, the imperial residence of the incas, under pretence that it lay within his destined territory. This produced a new quarrel; but peace was restored upon the determination of Almagro to attempt the conquest of Chili, and likewise to have part of the territory of Peru.

In 1535, he accordingly set out at the head of 570 Europeans, and in crossing the mountains, he suffered great hardships and losses by mistaking the route, but at length he descended into the plains of that devoted region. Here he met with a more vigorous resistance from the natives than the Spaniards had ever experienced in other countries. He had, however, made

some progress, when he was recalled to Peru by the news of the natives having risen in great numbers, and attacked Lima and Cuzco. He pursued a new route, and marching through the sandy plains on the coast, he suffered by heat and drought calamities not inferior to those which he had endured from cold and famine on the summit of the Andes. Arriving at a favourable moment, he resolved to hold the place both against the Indians and his Spanish rivals. He attacked the Peruvian army with great vigour, and making a great slaughter, he proceeded to the gates of Cuzco without any further interruption. The open, affable, and generous temper of Almagro, gained over to his side many of the adherents of the Pizarros, who were disgusted with their harsh and oppressive conduct. With their aid, he advanced towards the city by night, surprised the sentinels, and surrounded the house where the two brothers resided, who were compelled, after an obstinate defence, to surrender at discretion. A form of government was settled in the name of Almagro, and his jurisdiction over Cuzco was universally acknowledged. This was the origin of a civil war; the beginning of which was very advantageous to Almagro, who by skilful manœuvres entirely routed a body of Spanish troops advancing to the relief of Cuzco, and made Alvarado their commander prisoner. But instead of improving these advantages, he unwisely marched back to Cuzco, and there awaited the arrival of Pizarro. Pizarro, convinced of his own feeble resources, proposed an accommodation, and with his usual art protracted the negociation until he found himself in a condition to meet his antagonist in the field of battle. Meanwhile Alvarado and one of the Pizarros, by bribing their keepers, found means to escape, and persuaded 60 of the men who guarded them to attend them in their flight; and the governor released the other Pizarro. When Pizarro thought himself sufficiently prepared to settle the dominion of Peru, he marched with an army of 500 men to Cuzco. Almagro, previous to this, worn out with age and infirmity, resigned the command to Orgognez. A fierce and bloody battle ensued, in which Almagro was made prisoner, his army defeated, and the commander wounded. About 140 soldiers fell in the field, and Orgognez, along with several others, was massacred in cold blood. During that fatal day, Almagro, placed in a litter, which was stationed on an eminence, beheld from thence the total defeat of his troops, and felt all the indignation of a soldier who had seldom experienced defeat. He was taken prisoner, remained several months in confinement, and afterwards was tried, and condemned to death. In the view of an ignominious death, the courage of the veteran forsook him, and he unsuccessfully supplicated for life, in a manner unworthy of his former character. All the arguments he could employ were ineffectual. The Pizarros remained unmoved by all his entreaties. As soon, however, as Almagro saw that his fate was inevitable, he resumed his courage, and exhibited all his usual dignity and fortitude. In the year 1538, and in the 75th year of his age, he was strangled in prison, and afterwards beheaded. He left one son by an Indian woman of Panama; and in consequence of a power which the emperor had granted, he declared his son his successor

Almagro.

Almagro, in the government, although he was then a prisoner in Lima.

With the qualities of intrepid valour, indefatigable activity, and unsurmountable constancy, he blended the more amiable dispositions of frankness, generosity, and candour. These qualities rendered him beloved by his followers; and his misfortunes excited their sympathy and pity: so that his death was universally regretted, and particularly by the poor Indians, who deemed him their guardian and protector against the cruel and unfeeling Pizarro. Upon the whole review of his character, it appears just to conclude, that he was, although of inferior abilities, a more amiable man than his rival. (*Gen. Biog.*)

ALMAGRO the Younger, by his courage, generosity, and other accomplishments, was placed at the head of the party after the death of his father. The father, conscious of his own inferiority from the total want of education, used every possible means to improve the mind and embellish the manners of his son; so that he soon acquired those accomplishments which rendered him respected by illiterate adventurers, who cheerfully ranged round his standard; and, by his dexterity and skill, sought deliverance from the oppressions of Pizarro. Juan de Herrada, an officer of great abilities, continued still to direct his counsels and to regulate his enterprises: and, while Pizarro confided in his own security, a conspiracy was formed against him, which terminated in his death. The assassins, exulting in their success, and waving their bloody swords, hastened to the street, proclaimed the death of the tyrant, and compelled the magistrates and principal citizens of Lima to acknowledge Almagro as lawful successor of his father. But his reign was of short duration; for, in 1541, Vaca de Castro, arriving at Quito, produced the royal commission, appointing him governor of Peru, together with all the privileges and authority of Pizarro. The talents and influence of the new governor soon overpowered the interest of Almagro, who, perceiving the rapid decline of his influence, hastened with his troops to Cuzco, where his opponents had erected the royal standard under the command of Pedro Alvarez Holguin. Herrada the guide of his counsels died during his march; and from that time his measures were conspicuous for their violence, concerted with little ingenuity, and executed with little address. On September 16. 1542 at length the forces of Almagro and Vaca de Castro met, and victory long remained doubtful; till at last it declared for the new governor. The followers of Almagro displayed uncommon valour, and Almagro conducted the military operations of that fatal day with a gallant spirit, worthy of a better cause and deserving of a better fate. In proportion to the number of combatants the carnage was very great. Of 1500 men 500 fell in the field, and many more were wounded. Almagro escaped, but being betrayed by some of his own officers, he was publicly beheaded at Cuzco, and in him the name and spirit of the party of Almagro became extinct. (*Gen. Biog.*)

ALMAMON, or MAMON, also named *Abdallah*, caliph of Bagdad, was born A. D. 785. His elder brother Al Amin succeeded to the caliphate on the death of his father, and Almamon at that time was

governor of Chorasan. As by the will of the father it was provided, that his three sons should succeed to the caliphate in order, Almamon ordered his elder brother to be proclaimed caliph throughout his government. But his brother repaid his friendship and attachment to his interest with open expressions of hatred, and unjust attempts to exclude him from the destined succession. Almamon was thus forced to consult measures for his own safety and promotion, by causing himself to be proclaimed caliph. After various struggles, his general, Thaher, in the year 813, took possession of Bagdad, pursued Al Amin to his retreat, and caused him to be assassinated, so that Almamon remained without a competitor. Various rebellions disturbed the tranquillity of the first years of his reign; but by his prudent administration and vigorous exertions, these were at length extinguished. Instigated by the advice of his vizier, he soon after raised greater commotions, and exposed his dignity to greater dangers, by countenancing the sect of Ali. He invited to court Iman Rizza, gave him his daughter in marriage, and even declared him his successor in the empire. He assumed the green turban, the colour of the house of Ali, and obliged his courtiers and soldiers to imitate his example. Alarmed at these proceedings, the orthodox Mussulmans, and the house of Abbas, excited a great revolt in Bagdad, and proclaimed Ibrahim, Almamon's uncle, caliph. A civil war was just about to commence, when Fadel the vizier was assassinated, and Rizza died. The people of Bagdad then deposed Ibrahim, and returned to their former allegiance. Taking the advantage of Almamon's absence, Thaher his general seized upon the government of Chorasan, where he founded a dynasty which existed during a period of 16 years.

Almamon employed the period of tranquillity that followed, in the introduction and improvement of literature into his dominions, which constitutes the greatest glory of his reign. During the days of his father he discovered an ardent thirst after knowledge, by forming a college in Chorasan, adorned with the most eminent men of various countries; and appointed Mesue, a famous Christian physician of Damascus, for their president. When his father remonstrated against conferring such an honour upon a Christian, he reminded him, that the most learned men and the most skilful artists in his dominions were Jews and Christians; and added, that he had chosen Mesue as a preceptor in science and useful arts, and not as a teacher of religion. Under his auspices Bagdad became the seat of literature, of private and academical instruction, and the habitation of men of eminence from all quarters. Many valuable books in the Greek, Persian, Chaldean, and Coptic languages, among which were the works of Aristotle and Galen, were translated into the Arabic at his own expence. This caliph himself deemed it an honour to set an example to others of the becoming respect due to mental cultivation, by visiting the schools, and treating the professors with great regard. In mathematics, astronomy, and philosophy, he made a rapid and extensive progress. He was the author of astronomical tables, which on account of their accuracy have been much admired. By these various exertions the character of the Saracens was suddenly changed from

Almamon.

A. J. 1800. 10. 11.

a rude and ferocious to a polite and civilized people, while the most powerful and extensive of the European states were involved in ignorance and barbarism. Literature has sustained some irreparable losses from his too great partiality to the Arabic writers, which induced him to destroy the originals of the translated manuscripts. He is represented by the Sonnites or orthodox Mahometans as little better than an Infidel, because of his attention to philosophy and letters. His conduct, however, shows that he was not sufficiently careful to preserve a philosophical mean betwixt the different religious parties during the time of his administration, as he openly manifested a predilection to the doctrines of the Motazeli, who asserted the free will of man, and denied the eternity of the Koran. Some allege that on account of the murmurs which arose against him, he was induced to exhibit too great a zeal by establishing a kind of inquisition, to compel all his subjects to profess Islamism. The experiment, however, soon terminated in the better and juster expedient of universal toleration; and it is abundantly evident, that the Christians in his dominions never felt the power of his inquisition.

The public transactions of his reign are in themselves important. In the year 822 he sent a body of his troops to the assistance of Thomas, a Greek, who made war on Michael the Stammerer, the emperor of Constantinople, and besieged his capital. This expedition, which on the part of the caliph seems to have been founded in justice, proved unsuccessful; Thomas was taken prisoner, and suffered death. In the years 829 and 830, he commenced open hostilities upon the Greeks, rendered himself master of many places, and carried devastation into their territories. He was successful in suppressing a revolt in Egypt in the year 831. In this country he was led to discover a treasure buried under two columns by Merwan, the last caliph of the house of Ommijah. In repairing a decayed *mi-kias* or measuring pillar, and erecting a new one for determining the gradation of the increase of the Nile, Almamou displayed his love of science. In the year 833 he again visited Egypt; on his return he penetrated into the territories of the Greek emperor, even into Cilicia. Returning home he encamped on the banks of a river, and excited by thirst, he drank too freely of the water; and at the same time indulged himself immoderately in eating a particular kind of dates, which brought on a complaint in his stomach, and reduced him to the most imminent danger. Sensible of his approaching dissolution, he wrote letters into all the provinces, announcing his brother Motassem his successor; and then patiently awaited the event. After a tedious struggle under the pressure of his disease, and while uttering this ejaculation, "O thou who never diest, have mercy on me, a dying man?" he expired at the age of forty-eight or forty-nine years. He reigned 27 years and some months, and was buried at Tarsus, which some religious zealots interpreted as a mark of reprobation.

The history of this caliph affords an illustrious instance of the meliorating effect of science and literature upon the conduct and temper of rude and uncultivated men. Under the milder features of a liberal, virtuous, and beneficent sovereign, the usual cruelty of a Sara-

cen and a despot seemed entirely lost. He displayed an uncommon greatness of mind and an unusual example of clemency, in his conduct towards his rival and uncle Ibrahim. After his deposition, that prince concealed himself in some sequestered corner of Bagdad. The place of his concealment being at length discovered, he was instantly brought before the caliph, and informed that the council had unanimously condemned him to death. "Your counsellors (said Ibrahim) have judged according to the customary rules of political government; if you pardon me, you will not, indeed, judge according to precedent, but you will have no equal among sovereigns." The caliph rose up and embracing him tenderly with great emotion, said, "Uncle, be of good cheer; I will not do you the least injury;" and he added to forgiveness a fortune suitable to his birth and former elevated station. When Almamou's courtiers complimented him on this generous action, he exclaimed, "O! did men but know the pleasure I feel in pardoning, all who have offended me would come and confess their faults." To the same generosity of disposition may be ascribed his strong predilection to the oppressed house of Ali, which filled the beginning of his reign with political troubles. By his frequent intercourse with men of enlightened minds, and of different religious sentiments, he acquired a liberality very unusual in a Mussulman; and his preference to some particular opinions seems to have originated from his own vigour of mind, and his knowledge of these opinions. (*Gen. Biog.*)

ALMANACK, a book or table, containing a kalendar of days and months, the rising and setting of the sun, the age of the moon, the eclipses of both luminaries, &c.—Authors are divided with regard to the etymology of the word; some deriving it from the Arabic particle *al* and *manach*, to count; some from *almanach*, new-years gifts, because the Arabian astrologers used at the beginning of the year to make presents of their ephemerides; and others, from the Teutonic *almaen achte*, observations on all the months. Dr Johnson derives it from the Arabic particle *al*, and the Greek *μην*, a month. But the most simple etymology appears from the common spelling; the word being composed of two Arabic ones, *Al Manack*, which signify *the Diary*. All the classes of Arabs are commonly much given to the study of astronomy and astrology; to both which a pastoral life, and a sort of husbandry, not only incline them, but afford time and opportunity to cultivate them. They neither sow, reap, plant, travel, buy or sell, or undertake any expedition or business, without previously consulting the stars, or, in other words, their almanacks, or some of the makers of them. From these people, by their vicinity to Europe, this art, no less useful in one sense than trifling and ridiculous in another, hath passed over hither: and those astronomical compositions have still everywhere not only retained their old Arabic name; but were, like theirs, for a long while, and still are among many European nations, interspersed with a great number of astrological rules for planting, sowing, bleeding, purging, &c. down to the cutting of the hair and paring of the nails.—Regiomontanus appears to have been the first in Europe, however, who reduced almanacks into their present form and method, gave the characters of each

Almamou,
Almanack.

Almanack. each year and month, foretold the eclipses and other phases, calculated the motions of the planets, &c. His first almanack was published in 1474.

The essential part of an almanack is the kalendar of months and days, with the risings and settings of the sun, age of the moon, &c. To these are added various parerga, astronomical, meteorological, chronological, political, rural, &c. as calculations and accounts of eclipses, solar ingresses, prognostics of the weather, tables of the tide, terms, &c. lists of posts, offices, dignities, public institutions, with many other articles political as well as local, and differing in different countries. A great variety are annually published in Britain; some for binding, which may be denominated *book almanacks*; others in loose papers, called *sheet almanacks*.

The modern almanack answers to the *Fasti* of the ancient Romans. See *FASTI*.

Construction of ALMANACKS. The first thing to be done is, to compute the sun's and moon's place for each day of the year, or it may be taken from some ephemerides and entered into the almanack; next, find the dominical letter, and, by means thereof, distribute the kalendar into weeks; then, having computed the time of Easter, by it fix the other moveable feasts; adding the immoveable ones, with the names of the martyrs, the rising and setting of each luminary, the length of day and night, the aspects of the planets, the phases of the moon, and the sun's entrance into the cardinal points of the ecliptic, i. e. the two equinoxes and solstices. (See *ASTRONOMY, passim*). By the help of good astronomical tables or ephemerides, the construction of almanacks is extremely easy.

For every almanack or kalendar for one year or less, a stamp duty of 8d. must be paid. And for every almanack serving more than a year, the same duty is paid for each year. Perpetual almanacks pay for three years only. All books and pamphlets serving chiefly the purpose of almanacks, are charged as such. If any almanack contains more than one sheet, one sheet only need be stamped; and every almanack is required by law to be so printed, that some part of the print shall be upon the stamp. Selling unstamped almanacks incurs the same penalty as for selling unstamped newspapers. Almanacks in bibles and common prayer books are exempted.

ALMANACKS, among *Antiquaries*, is also the name given to a kind of instrument, usually of wood, inscribed with various figures and Runic characters, and representing the order of the feasts, dominical letters, days of the week, and golden number, with other matters necessary to be known throughout the year; used by the ancient northern nations, in their computations of time, both civil and ecclesiastical. Almanacks of this kind are known by various names, among the different nations wherein they have been used; as rim-stocks, primstaries, runstocks, runstuffs, *Scipiones Runicæ*, *Bacculi Annales*, clogs, &c. They appear to have been used only by the Swedes, Danes, and Norwegians. From the second of these people, their use was introduced into England, whence divers remains of them in the counties. Dr Plot has given the description and figure of one of these clogs, found in Staffordshire, under the title of *The Perpetual Staffordshire Almanack*. The external figure and matter of these kalendars appear to have been various. Some-

times they were cut on one or more wooden leaves, bound together after the manner of books; sometimes on the scabbards of swords, or even daggers; sometimes on tools and implements, as portable steelyards, hammers, the helves of hatchets, flails, &c. Sometimes they were made of brass or horn; sometimes of the skins of eels, which being drawn over a stick properly inscribed, retained the impressions of it. But the most usual form was that of walking staves, or sticks, which they carried about with them to church, market, &c. Each of these staves is divided into three regions; whereof the first indicates the signs, the second the days of the week and year, and the third the golden number. The characters engraven on them are, in some, the ancient Runic; in others the latter Gothic characters of Ulfilas. The saints days are expressed in hieroglyphics, significative either of some endowment of the saint, the manner of his martyrdom, or the like. Thus against the notch for the first of March, or St David's day, is represented a harp; against the 25th of October, or Crispin's day, a pair of shoes; against the 10th of August, or St Lawrence's day, a gridiron; and, lastly, against New-year's day, a horn, the symbol of liberal potations, which our ancestors indulged in at that period.

ALMANSOR the Victorious, the second caliph of the house of Al Abbas, succeeded his brother Abul Abbas Al Saffah, in the year 753, of the Hegira 136, and in the following year was inaugurated at Al Hashemiyah. Although Al Saffah had declared him presumptive heir of the crown, and he had been proclaimed caliph in the imperial city of Anbar, yet immediately upon his inauguration, his uncle Abdallah ebn Ali had sufficient interest to cause himself to be proclaimed caliph at Damascus. In Arabia, Syria, and Mesopotamia, he collected a numerous army, and arrived at the banks of the Masius, near Nisibis, where he encamped, ready to dispute his royal accession by arms. Almansor collected an immense army in Persia, Khorasan, and Irak, and gave the command of it to Abu Moslem, who harassed his uncle's troops for five months, and at last totally defeated him, A. D. 754. Notwithstanding the services which Abu Moslem had rendered to the family of Al Abbas, after this victory he became an object of jealousy, and was assassinated in the presence of Almansor himself, by his express order. After the death of Abu Moslem, the standard of rebellion was raised by Simon a Magian, who seized on the treasures of the deceased governor of Khorasan, and excited the people of that country to a general revolt; but this insurrection was suddenly quelled by the general of Almansor, Jamhur ebn Morad. The caliph avariciously seized the spoils of this victory, which so incensed Jamhur that he immediately turned his arms against his royal master; but he was soon defeated by the caliph's forces. The patriarch of Antioch was about this time detected in an illicit correspondence with the Grecian emperor, and consequently was banished into an obscure part of Palestine; and in the mean time the Christians in the dominions of the caliph were prohibited from building or repairing any churches, and also were laid under several other severe restraints.

Almansor sent a large army into Cappadocia in the year 757, fortified the city of Malatia or Me-

Almansor.

litene, and deposited in it a great part of his treasures. But in this year he was attacked by a sect of believers in the metempsychosis, called the *Rawandians*. This sect assembled at Al Hashemiyah, the residence of the caliph, and by the ceremony of going in procession round his palace, intimated their purpose of invoking him as a deity, and paying him divine homage. Incensed by their impiety, the caliph ordered several of these sectaries to be imprisoned, which roused their resentment, and led them to form the design of his assassination. The generous interposition of Maan ebn Zaidet, an Ommyan chief, who had been under the necessity of concealing himself from the caliph's resentment, however, defeated their intention. This insult received in his capital, induced him to build the city of Bagdad, and to fix his residence there, A. D. 762. In the preceding year a plan was formed to dethrone him; but it being discovered, he severely punished all who were either directly or indirectly concerned in it. Abdallah his uncle shared the fate of other rebels; for being allured to court under the promise of pardon and protection, he was placed in a building which was so constructed that it immediately fell and crushed him in its ruins. Not long after his residence at Bagdad, he was seized with a disorder of which he was cured by the advice of a famous Christian physician, whose name was George ebn Baktishua Al Jondisaburi. The caliph, previously informed that he was married to a wife old and infirm, as a recompense presented him with three beautiful Greek girls, and a considerable sum of money; the girls, to the caliph's surprise, were sent back, with a declaration on the part of George, that it was not lawful for a Christian to have more wives than one at a time. The conduct of the physician, on this occasion, raised him in the esteem of the caliph, and procured him a greater profusion of favours. In his succeeding military transactions, Almanzor was generally victorious. His conduct to his Christian subjects was rigorous and severe. He set out on a pilgrimage to Mecca in the year 774, and being seized on the road with a dangerous disease, he sent for his son and intended successor Al Mohdi, and gave him some salutary advice. "I command you," said he, "to treat publicly your relations with the greatest marks of distinction, since this conduct will reflect no small degree of honour and glory upon yourself. Increase the number of your freedmen, and treat them with all kindness, as they will be of great service to you in your adversity; but neither this nor the other injunction will ye fulfil. Enlarge not that part of your capital erected on the eastern bank of the Tigris, as you will never be able to finish it; but this work I know you will attempt. Never permit any of your women to intermeddle in affairs of state, or to have any influence over your councils; but this advice I know you will not take. These are my last commands; or, if you please, my dying advice; and to God I now recommend you." In parting they both gave vent to their feelings in a flood of tears. He pursued his journey to Bir-Maimun, *i.e.* the well of Maimun, where he died in the 63d year of his age and 20th of his reign, and his remains were interred at Mecca.

The character of Almanzor was formed of very different and even contradictory qualities. His temper conciliated affection and attachment in private life, but

in his public character his aspect and demeanour inspired terror. He was well acquainted with the arts of government; he was prudent and brave, but perfidious, covetous, cruel, and implacable; and amid such a variety of character, it is singular that he should have displayed a love of study and literature, and particularly of astronomy. (*Gen. Biog.*)

ALMANZA, a little town of New Castile, on the frontiers of the kingdom of Valencia in Spain, situated in W. Long. 1. 19. N. Lat. 38. 54. It is remarkable for the defeat of the allies in 1707, under the marquis de las Minas and the earl of Galway. In the beginning of this action the English troops penetrated through the centre of the Spanish army; but the Portuguese cavalry being broken by the Spanish, and the French infantry making a dreadful fire on their flanks, the allied army was at last broken, and began their retreat when it was almost dark. Colonel Hill carried off the remains of thirteen battalions towards the river Xucar, which, if they could have passed, they might have been safe: but being very much fatigued, they were obliged to halt; by which means they were surrounded, and forced to surrender prisoners of war. In this battle, the allies lost 120 standards, together with all their artillery and baggage; a great number were killed, and several thousands taken prisoners. The marquis de las Minas was dangerously wounded; and his mistress, in the garb of an amazon, killed by his side. The earl of Galway had two cuts across the face, which, though not dangerous, had prevented him from seeing, or giving orders properly.

HERESY OF ALMARIC, a tenet broached in France by one Almaric, in the year 1209. It consisted in affirming, that every Christian was actually a member of Christ; and that without this faith no one could be saved. His followers went farther, and affirmed that the power of the Father lasted only during the continuance of the Mosaic law; that the coming of Christ introduced a new law; that at the end of this began the reign of the Holy Ghost; and that now confession and the sacraments were at an end, and that every one is to be saved by the internal operation of the Holy Spirit alone, without any external act of religion.—Their morals were as infamous as their doctrine was absurd. Their tenets were condemned by a public decree of the council of Sens, in the year 1209.

ALME, or ALMA, singing and dancing girls in Egypt, who, like the Italian *Improvvisatori*, can occasionally pour forth "unpremeditated verse." They are called *Almé*, from having received a better education than other women. They form a celebrated society in that country. To be received into it, according to M. Savary, it is necessary to have a good voice, to understand the language well, to know the rules of poetry, and be able to compose and sing couplets on the spot, adapted to the circumstances. The *Almé* know by heart all the new songs. Their memory is furnished with the most beautiful tales. There is no festival without them; no entertainment of which they do not constitute the ornament. They are placed in a rostrum, from whence they sing during the repast. They then descend into the saloon, and form dances which have no resemblance to ours. They are pantomime ballets, in which they represent the usual occurrences of life. The mysteries of love, too, generally

Almansor

Almé.

Almé
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Almehrab.

nerally furnish them with scenes. The suppleness of their bodies is inconceivable. One is astonished at the mobility of their features, to which they give at pleasure the impression suited to the characters they play. The indecency of their attitudes is often carried to excess. Their looks, their gestures, every thing speaks, but in so expressive a manner, that it is impossible to mistake them. At the beginning of the dance, they lay aside with their veils the modesty of their sex. A long robe of very thin silk goes down to their heels, which is slightly fastened with a rich girdle. Long black hair, plaited and perfumed, is flowing on their shoulders. A shift, transparent as gauze, scarcely hides their bosom. As they put themselves in motion, the shapes, the contours of their bodies, seem to develope themselves successively. Their steps are regulated by the sound of the flute, of castanets, the tambour de basques, and cymbals, which accelerates or retards the measure. They are still further animated by words adapted to such scenes. They appear in a state of intoxication. They are the bacchantes in a delirium. It is when they are at this point, that throwing off all reserve, they abandon themselves totally to the disorder of their senses; it is then that a people far from delicate, and who like nothing hidden, redouble their applauses. These Almé are sent for into all the harems. They teach the women the new airs; they amuse them with amorous tales, and recite in their presence poems, which are so much the more interesting, as they furnish a lively picture of their manners. They initiate them into the mysteries of their art, and teach them to contrive lascivious dances. These girls, who have a cultivated understanding, are very agreeable in conversation. They speak their language with purity. The habit of dedicating themselves to poetry renders the softest and most sonorous expressions familiar to them. They repeat with a great deal of grace. In singing, nature is their only guide. Sometimes two of them sing together, but always with the same voice. It is the same with an orchestra, where all the instruments playing in unison execute the same part.

The Almé assist at the marriage ceremonies, and march before the bride, playing on instruments. They make a figure likewise at funerals, and accompany the procession, singing sorrowful airs. They break forth into groans and lamentations, and give every sign of grief and despair. These women are paid very high, and seldom appear but amongst the grandes and rich men.

The common people have also their Almé. They are girls of the second class, who try to imitate the former; but they have neither their elegance, their graces, nor their knowledge. They are everywhere to be met with. The public places and the walks about Grand Cairo are full of them. As the populace require allusions still more strongly marked, decency will not permit the relation to what a pitch they carry the licentiousness of their gestures and attitudes.

ALMEDIA, a frontier town of Portugal, in the province of Tralos Montes, on the confines of Leon, where there was a very brisk action between the French and Portuguese in 1663; 17 miles north-west of Ciudad Rodrigo. W. Long. 7. 20. N. Lat. 40. 31.

ALMEHRAB, in the Mahometan customs, a niche in their mosques, pointing towards the kebla or temple

of Mecca, to which they are obliged to bow in praying. See KEBLA.

ALMEISAR, a celebrated game among the ancient Arabs, performed by a kind of casting of lots with arrows, strictly forbidden by the law of Mahomet, on account of the frequent quarrels occasioned by it.

The manner of the game was thus: A young camel being brought and killed, was divided into a number of parts. The adventurers, to the number of seven, being met, 11 arrows were provided without heads or feathers; seven of which were marked, the first with one notch, the second with two, the third with three, &c. the other four had no marks. These arrows were put promiscuously into a bag, and thus drawn by an indifferent person. Those to whom the marked arrows fell, won shares in proportion to their lot; the rest, to whom the blanks fell, were entitled to no part of the camel, but obliged to pay the whole price of it. Even the winners tasted not of the flesh themselves more than the losers, but the whole was distributed to the poor.

ALMENE, in *Commerce*, a weight of two pounds, used to weigh saffron in several parts of the continent of the East Indies.

ALMERIA, a sea-port town in the kingdom of Granada in Spain, pleasantly situated on a fine bay at the mouth of the river Almeria, on the Mediterranean. W. Long. 2. 35. N. Lat. 36. 51. This town is by some thought to have risen upon the ruins of the ancient Abdera, and was formerly a place of great consequence. It was taken from the Moors in 1147, by the emperor Conrad III. in conjunction with the French, Genoese, and Pisans. It was at that time the strongest place in Spain held by the Infidels; from which their privateers, which were exceedingly numerous, not only troubled the sea-coasts inhabited by the Christians, but gave equal disturbance to the maritime provinces of France, Italy, and the adjacent islands. The city being well fortified, having a strong castle, a numerous garrison, and being excellently provided with every thing necessary, made a vigorous resistance; but was at last taken by storm, when the victor put to the sword all the inhabitants who were found in arms, distributing the best part of the plunder among his allies, whom he sent away thoroughly satisfied. The Genoese, particularly, acquired here that emerald vessel which still remains in their treasury, and is deemed invaluable.

Upon its reduction by the Christians, Almeria became a bishopric; but is at present very little better than a village, indifferently inhabited, and has nothing to testify so much as the probability of its former greatness, except certain circumstances which cannot be effaced even by the indolence of the Spaniards themselves. What these are, Udal ap Rhys, a Welshman, thus describes, in his Tour through Spain and Portugal. "Its climate (says he) is so peculiarly blessed, that one really wants words to express its charms and excellence. Its fields and meads are covered with flowers all the year round; they are adorned also with palms, myrtles, plane trees, oranges, and olives; and the mountains and promontories near it are as noted for their producing a great variety of precious stones, insomuch that the next promontory to it is called the *Cape of Gates*, which is a corruption from the word *agates*, the

Almehrab
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Almeria.

Almeria hills thereabouts abounding in that sort of precious stones, as well as in emeralds and amethysts, garnets or coarse rubies, and extreme curious alabaster in the mountains of Filaures."

ALMIGGIM. See ALMUGGIM.

ALMEYDA, DON FRANCIS, was the son of the Count d'Abrantes, a grandee of Portugal, who served with great distinction in the war of Ferdinand of Castile with Granada; and in consequence of his important services he became highly esteemed in the court of his sovereign. Without any solicitation on his part he was nominated the first governor general and viceroy of the newly conquered countries in the East Indies; and set sail from Lisbon in March 1505-6 with a powerful fleet. To give dignity and influence to his elevated station, a body of guards was appointed to attend his person, several chaplains were assigned him, together with every other appendage of grandeur. He touched at the Cape Verd islands, doubled the cape at a considerable distance to the south, and arrived at Guiloa. From thence he proceeded to Mombaza, a well fortified city in an island, which he reduced, and proceeded to the Angediva islands not far from Goa, where he built a fort; he likewise erected and garrisoned another fort at Cannanor, and arriving at Cochin, he secured it to the Portuguese interest. The island of Madagascar was discovered during his government, and his son Don Lorenzo first surveyed the Maldivé islands; and about the same time discovered the fine island of Ceylon, the principal sovereign of which he brought under submission to the crown of Portugal. Returning from this expedition, while employed in the fleet destined against Calicut, he lost his life in a sea-fight against the Zamorin. His father sustained his loss with a heroic firmness, saying, "that Lorenzo could not die better than in the service of his country." On the arrival of Alphonso d'Albuquerque, who was destined to be his successor, Almeyda yielded to the impressions of jealousy; and under the pretence of misconduct he confined him in the citadel of Cannanor. He engaged in 1508, the whole force of the Mahometans in the port of Din; and, gaining a complete victory, facilitated the enterprises of Albuquerque his successor, by contributing to break that formidable league by which the Zamorin was in hopes of being able to compel the Portuguese to abandon their Indian conquests. Returning home with the great riches which he had acquired, he unfortunately touched at Saldanha Point on the coast of Africa, where some of the sailors, in quest of water, quarrelled with the natives, who attacked and drove them to their ships. With a view to revenge this pretended affront, they persuaded Almeyda himself to go ashore, with a body of 150 men, armed only with swords and lances. While stepping into the boat, Almeyda exclaimed, "whither do you carry my 60 years?" The Portuguese furiously rushed on to attack the natives, whose numbers were greatly augmented, and Almeyda with 57 of his men were killed in this rash and unprovoked attempt. (*Gen. Biog.*)

ALMISSA, a small but strong town at the mouth of the Cetina, in Dalmatia, famous for its piracies; ten miles east of Spalatro. E. Long. 18. 14. N. Lat. 43. 56.

ALMOHEDES, the name of a dynasty, which,

in the commencement of the twelfth century, succeeded that of the Almoravides in Barbary. It derived its name from an obscure founder called Al Mohedi, or Al Mohedes, and it rose into public notice in the 25th year of the reign of Al Abraham, or Brahem, who succeeded his father Ali, A. D. 1115. This person was a Bereber, and was a famous preacher of the tribe of Muzamada, which was settled along Mount Atlas. His scheme was the exertion of ingenuity, and it was executed with unremitting activity. In order to obtain attention and success, he assumed the title of Mohdi or Mohedi, and claimed the honour of leader of the orthodox, or unitarians, and, by his preaching they become so numerous, that he even dared to set the royal power at defiance. Confident of security, and immersed in pleasure, Brahem looked with a contemptuous eye upon the insurrection of a party composed of such persons. They increased in number and strength, so that the king was at last roused from his indolence, and prepared for his own security and their subjection. In the first engagement he was defeated, being overpowered with superior numbers. The artful Abdallah took possession of the capital, so that Brahem, pursued as a fugitive by Abdolmumen, one of the party, sought refuge in the city of Fez. The gates were shut against him; but they were opened to admit his pursuers. He next took refuge in the city of Auran, or Oran; but he was pursued by Abdolmumen, who threatened to destroy the city with fire and sword; and the magistrates, unable to defend themselves, urged him to leave the town, and provide for his own safety. Concealed by the darkness of the night, he escaped with his favourite wife on horseback behind him; but being closely pursued by the enemy, rather than fall into their hands, he rushed over a precipice, and, along with his wife, he was dashed to pieces. Such was the death of this prince, which put a final period to the empire of the Almoravides. When the death of Brahem was known, Abdolmumen was chosen by the chiefs of that party his successor, and proclaimed king of the Al-mohedes, under the title of Al Emir Al Mumin Abdallah Mohammed Abdal Mumin Ebn Abdallah Ibn Ali, i. e. Chief or Emperor of the true Believers of the house of Mohammed Abdal Mumin, the son of Abdal Mumin, the son of Abdallah, of the lineage of Ali. Abdallah, during his reign, enacted prudential laws for the establishment of his new kingdom, and the regulation of the conduct of his followers. He appointed a council of forty of his disciples, all of whom were preachers. Some of these were commissioned to regulate all public affairs; and at proper seasons they went forth as itinerant preachers for the purpose of strengthening their party, and spreading their doctrines, and sixteen of their number acted as secretaries. As both the regal and pontifical dignities were united in the same person, the king was chosen from both of these two classes. The disciples of this sect were denominated Mohameddin, or Ali Mohaddin; but the Arabian writers only style them preachers, and the Spanish Al-Mohedes. The descendants and successors of that tribe continued to retain the appellation of Emir Al Mumin, or chiefs of the faithful believers, as long as their dynasty lasted; and they became very powerful both in Africa and Spain. By their invectives against

Almohedes. the tyranny of the Almoravides, and their loud clamours for liberty, they induced the greater part of the kingdom to revolt, and to embrace their religious doctrines. The chief thing in them was their specious pretence to orthodoxy, and strict adherence to the unity of the Godhead, which they inculcated with the greatest zeal and diligence.

On his accession to power, the new sovereign extirpated all the unhappy remains and steady adherents of this race, by strangling Isaac the son of Brahem. The Almoravides governor taking advantage of the general tumult and distraction that prevailed, constituted their governments into independent principalities and petty kingdoms; and they who inhabited the mountainous parts, established under their own cheyks a variety of lordships. The Libyans and Nubians took the lead; and the states of Barbary, Tripoli, Kairwan, Tunis, Algiers, Tremecen, and Bujeyah, followed their example. Abdolmumen, however, successfully pursued his conquests; and in a few years he reduced to his subjection the Numidians and Galatians in the west, and the kingdoms of Tunis, Tremecen, and the greater part of Mauritania and Tingitana. He expelled the Christians of Mohedia, the chief city of Africa, and some others on the same coast; and likewise made conquests both in Spain and Portugal. He died in the seventh year of his reign, and was succeeded, A. D. 1156, by his son Yusef or Joseph. Yusef proved a valiant and martial prince, and in his military court he first established the kings of Tunis and Bujeyah in their respective dominions, as his tributaries and vassals; and then by earnest solicitation he embarked for Spain to assist the Moorish princes. Yakub or Jacob, or the Conqueror, succeeding him, after providing for his own safety against the revolted and plundering Arabs, pursued his conquests with such success, that he soon became master of the whole country lying between Numidia and the entire length of the Barbary coasts, from Tripoli to the boundaries of the kingdom of Morocco. Thus he was acknowledged as sovereign by most of the Arabian Moorish princes in his Spanish dominions; but also extended his territory above 1200 leagues in length, and 480 in breadth. The remaining part of the history of this prince is involved in obscurity. About the year 1206, he quelled a revolt in Morocco, but violated his faith with the governor of the capital, which he reduced, and in a cruel and perfidious manner he extirpated all his adherents. Touched, it is said, with remorse, he disappeared, and, according to report, wandered about obscure and unknown, until he died in the humble condition of a baker at Alexandria. His son Mohammed, surnamed Al Naker, succeeded his father; and, on his accession to the crown, he passed over into Spain with an immense army of 120,000 horse and 300,000 foot, and engaging the whole force of the Christians on the plains of Tholosa, received a total defeat, with the loss of above 150,000 foot, 30,000 horse, and 50,000 prisoners. According to Spanish and other historians, this famous battle was fought in 617, A. D. 1220; but according to the Arabian writers, it was in the year of the Hegira 609, A. D. 1212. Returning home to Africa, he was received with coldness and disgust by his subjects, on account of his defeat; and soon after died of vexation, having appointed his grand-

son Zeyed Arrax his successor. A descendant of the Abdolwates, ancient monarchs of the kingdom, named Gamarazan Ebn Zeyen, of the tribe of the Zeneti, caused him to be assassinated. With him terminated the dynasty or government of the Almohedes, having possessed it for about 170 years, which gave place to that of the Benimerini, another branch of the Zeneti. These having enlarged their conquests, and enriched themselves by frequent inroads, not only into the neighbouring kingdoms, but even Nubia, Libya, and Numidia, were at length lost in the general prevalence of Mohamedism, after having existed 117 years. (*Mod. Univ. Hist.*)

ALMOND, the fruit of the almond tree. See **AMYGDALUS**, **BOTANY Index**.

ALMOND, in *Commerce*, a measure by which the Portuguese sell their oil: 26 almonds make a pipe.

ALMONDS, in *Anatomy*, a name sometimes given to two glands, generally called the *tonsils*.

ALMONDS, among lapidaries, signify pieces of rock-crystal, used in adorning branch-candlesticks, &c. on account of the resemblance they bear to the fruit of that name.

ALMOND Furnace, among refiners, that in which the slags of litharge, left in refining silver, are reduced to lead again by the help of charcoal.

ALMONDBURY, a village in England, in the west riding of Yorkshire, six miles from Halifax.

ALMONER, in its primitive sense, denotes an officer in religious houses, to whom belonged the management and distribution of the alms of the house. By the ancient canons, all monasteries were to spend at least a tenth part of their income in alms to the poor. The almoner of St Paul's is to dispose of the moneys left for charity, according to the appointment of the donors, to bury the poor who die in the neighbourhood, and to breed up eight boys to singing, for the use of the choir. By an ancient canon, all bishops are required to keep almoners.

Lord ALMONER, or **Lord High ALMONER of England**, is an ecclesiastical officer, generally a bishop, who has the forfeiture of all deodands, and the goods of *felos de se*, which he is to distribute among the poor. He has also, by virtue of an ancient custom, the power of giving the first dish from the king's table to whatever poor person he pleases, or, instead of it, alms in money.

Great ALMONER, **Grand AUMONIER**, in France, before the revolution, was the highest ecclesiastical dignity in that kingdom. To him belonged the superintendency of all hospitals and houses of lepers. The king received the sacrament from his hand; and he said mass before the king in all grand ceremonies and solemnities.

ALMONER is also a more fashionable title given by some writers to chaplains. In this sense we meet with almoner of a ship, almoner of a regiment.

ALMONRY, or **AUMBRY**, the office or lodgings of the almoner; also the place where alms are given. See **AMBRY**.

ALMORAVIDES, in *History*, the name of an Arab tribe, who took possession of a district of Africa, with the pretence of living in retirement, that their minds might not be distracted from the rigid observance of the precepts of the Koran. Hence they assumed the name of Morabites, which was changed by the

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Almoravides.

Almoravides.

the Spaniards into that of Almoravides. Abubeker ben Omar, called by the Spanish authors Abu Texefien, was the first chief of this tribe. Supported by a powerful army of malecontents from the provinces of Numidia and Libya, which was assembled by the influence of the Morabites, or Marabouts, he founded the dynasty of the Almoravides in Barbary, in the year 1051. Texefien was succeeded by his son Yusef or Joseph, who, after having reduced to a state of vassalage the kingdoms of Tremecen, Fez, and Tunis, passed over into Spain during the time of the civil wars, vigorously repulsed the Christians, and soon saw the greatest part of the kingdoms of Murcia, Granada, Cordova, Leon, and some parts of Valencia, subjected to his power. He then returned into Africa, and left his newly acquired dominions, with a considerable army, under the government of his nephew Mohammed. On his arrival in Africa, with a view to prosecute and extend his conquest in Spain, he announced, in a public declaration, a general *gazie*, or religious war; assembled a numerous army, with which he embarked at Ceuta; and rejoining his nephew in Andalusia, soon laid waste that province with fire and sword.

In the year 1107, five years afterwards, he undertook another invasion, penetrated into the kingdom of Portugal, and reduced the city of Lisbon, with a considerable part of the kingdom. At this time he lost the cities of Aguarizir and Gibraltar, which he had formerly taken. On his return to Barbary, he was defeated at sea. This induced him to propose a truce, which was agreed to only on condition of his submitting to become the tributary of the Spanish king. Indignant at these humiliating terms, Yusef made a vow that he would never desist in his attempts till he had utterly rooted out the Christian religion in Spain. He made preparations accordingly for a fresh invasion, embarked his army, and landing at Malaga, marched into the enemy's country. His progress was rapid; but his measures were inconsiderately planned and rashly executed. In the famous battle of the Seven Counts, he was indeed victorious, but after a terrible slaughter, and the loss of a great part of his army. This disastrous victory obliged him to return to Africa; and he died soon after at his capital of Morocco. Ali, his son, succeeded to the sovereignty in 1110. This prince, who seems to have been of a less warlike disposition than his father, neglecting his Spanish conquests, turned his attention to the arts of peace, and erected many sumptuous buildings, and in particular the great mosque of Morocco. Alphonso, then king of Arragon, retook from him some considerable cities; which obliged him to undertake an expedition to Spain in support of the Moorish princes. But all his attempts proved unfortunate; and in his last enterprise, though powerfully assisted by the Moorish chiefs, with the loss of 30,000 men he was defeated and slain by Alphonso, in the sixth year of his reign.

He was succeeded by his son Al Abraham, who devoted himself entirely to pleasure. His subjects were harassed and oppressed with heavy taxes, which excited discontent and open rebellion. A revolution was soon effected, and in the 25th year of his reign, the government transferred from the tribe of the Almoravides to the Almohedes. (*Mod. Univ. Hist.*)

ALMS, a general term for what is given out of charity to the poor.

In the early ages of Christianity, the alms of the charitable were divided into four parts; one of which was allotted to the bishop, another to the priests, and a third to the deacons and subdeacons, which made their whole subsistence; the fourth part was employed in relieving the poor, and in repairing the churches.

No religious system is more frequent or warm in its exhortations to almsgiving than the Mahometan. The Alcoran represents alms as a necessary means to make prayer be heard. Hence that saying of one of their caliphs: "Prayer carries us half way to God, fasting brings us to the door of his palace, and alms introduces us into the presence chamber." Hence many illustrious examples of this virtue among the Mahometans. Hasan the son of Ali, and grandson of Mohammed, in particular, is related to have thrice in his life divided his substance equally between himself and the poor, and twice to have given away all he had. And the generality are so addicted to the doing of good, that they extend their charity even to brutes.

ALMS, also denotes lands or other effects left to churches or religious houses, on condition of praying for the soul of the donor. Hence.

Free ALMS, that which is liable to no rent or service.

Reasonable ALMS, a certain portion of the estates of intestate persons, allotted to the poor.

ALMS-Box, or *Chest*, a small chest or coffer, called by the Greeks *Kapsalon*, wherein anciently the alms were collected, both at church and at private houses.

The alms-chest, in English churches, is a strong box, with a hole in the upper part, having three keys, one to be kept by the parson or curate, the other two by the church-wardens. The erecting of such alms-chest in every church is enjoined by the book of canons, as also the manner of distributing what is thus collected among the poor of the parish.

ALMS House, a petty kind of hospital for the maintenance of a certain number of poor, aged, or disabled people.

ALMUCANTARS, in *Astronomy*, an Arabic word denoting circles of the sphere passing through the centre of the sun or a star, parallel to the horizon, being the same as *PARALLELS of Altitude*.

ALMUCANTAR's Staff, is an instrument usually made of pear tree or box, having an arch of 15 degrees; used to take observations of the sun, about the time of its rising and setting, in order to find the amplitude, and consequently the variation of the compass.

ALMUCIUM denotes a kind of cover for the head, worn chiefly by monks and ecclesiastics. It was of a square form, and seems to have given rise to the bonnets of the same shape still retained in universities and cathedrals.

ALMUGGIM, ALMIGGIM, or ALMUG TREE, a certain kind of wood mentioned in the first book of Kings (x. 11.), which the Vulgate translates *lignathyina*, and the Septuagint wrought wood. The Rabbins generally render it coral; others, ebony, brazil, or pine. But it is observed, that the almug tree can by no means be coral, because that is not fit for the purposes that the Scripture tells us the almug tree

Alms

Almuggim.

almuggin was used, such as musical instruments, staircases, &c. The word *thyinum* is a name for the citron tree, known to the ancients, and very much esteemed for its sweet odour and great beauty. It came from Mauritania. The *almug* tree, or *almuggin*, *algumim*, or simply *gum-mim*, taking *al* for a kind of article, is therefore by the best commentators understood to be an oily and gummy sort of wood; and particularly that sort of tree which produces the gum ammoniac, which is also thought to be the same with the Shittim wood, whereof there is such frequent mention made by Moses.

ALMUNECAR, a sea-port town in the kingdom of Granada, seated on the Mediterranean, with a good harbour, defended by a strong castle, 20 miles south of Alhama. W. Long. 3. 55. N. Lat. 36. 50.

ALNAGE, or AULNAGE, the measuring of woollen manufactures with an ell. It was at first intended as a proof of the goodness of that commodity; and accordingly a seal was invented as a mark that the commodity was made according to the statute; but, it being now possible to purchase these seals, they are affixed, whenever the vender pleases, to all cloths indiscriminately, to the great prejudice of our woollen manufactures.

ALNAGER, ALNEGER, or AULNEGER, q. d. *measurer by the ell*, signifies a sworn public officer, who, by himself or deputy, is to look to the assize of woollen cloth made throughout the land, i. e. the length, width, and work thereof; and to the seals for that purpose ordained. The office of king's alnager seems to have been derived from the statute of Richard I. A. D. 1197, which ordained that there should be only one weight and one measure throughout the kingdom; and that the custody of the assize, or standard of weights and measures, should be committed to certain persons in every city and borough. His business was, for a certain fee, so measure all cloths made for sale, till the office was abolished by the statute 11 and 12 W. III. cap. 20.

ALNUS, the ALDER TREE. See BETULA, BOTANY Index.

ALNUS, in the ancient theatres, that part which was most distant from the stage.

ALNWICK, a thoroughfare town in Northumberland, on the road to Scotland. Here Malcolm, king of Scotland, making an inroad into Northumberland, was killed, with Edward his son, and his army defeated, by Robert Moubay, earl of this county, anno 1092. Likewise William, king of Scotland, in 1174, invading England with an army of 80,000 men, was here encountered, his army routed, and himself made prisoner. The town is populous, and in general well built; it has a large town-house, where the quarter-sessions and county-courts are held, and members of parliament elected. It has a spacious square, in which a market is held every Saturday. Alnwick appears to have been formerly fortified, by the vestiges of a wall still visible in many parts, and three gates which remain almost entire. It is governed by four chamberlains, who are chosen once in two years out of a common council, consisting of 24 members. It is ornamented by a stately old Gothic castle, which has been the seat of the noble family of Percy, earls of Northumberland. As the audits for receipt of rents have ever been in the castle, it has always been kept

in tolerable repair; and not many years ago it was repaired and beautified by the duke of Northumberland, who made very considerable alterations, upon a most elegant plan, with a view to reside in it some part of the summer season. The manner of making freemen is peculiar to this place, and indeed is as ridiculous as singular. The persons who are to be made free, or, as the phrase is, leap the well, assemble in the market-place, very early in the morning, on the 25th of April, being St Mark's day. They appear on horseback, with every man his sword by his side, dressed in white, and with white nightcaps, attended by the four chamberlains and the castle bailiff, mounted and armed in the same manner; from hence they proceed, with music playing before them, to a large dirty pool, called *Freeman's-well*, where they dismount, and draw up in a body, at some distance from the water; and then rush into it all at once, and scramble through the mud as fast as they can. As the water is generally very foul, they come out in a dirty condition; but taking a dram, they put on dry clothes, remount their horses, and ride full gallop round the confines of the district; then re-enter the town, sword in hand, and are met by women dressed in ribbons with bells and garlands, dancing and singing. These are called *timber-wasts*. The houses of the new freemen are on this day distinguished by a great holly bush, as a signal for their friends to assemble and make merry with them after their return. This ceremony is owing to King John, who was mired in this well, and who, as a punishment for not mending the road, made this a part of their charter. Alnwick is 310 miles north-by-west from London, 33 north of Newcastle, and 29 south of Berwick. Long. 1. 10. Lat. 55. 24. Its population in 1811 was 5426.

ALOA, in Grecian antiquity, a festival kept in honour of Ceres by the husbandmen, and supposed to resemble our harvest-home.

ALOE, in Botany. See BOTANY Index.

American ALOE. See AGAVE, BOTANY Index.

ALOGIANS, in Church History, a sect of ancient heretics, who denied that Jesus Christ was the Logos, and consequently rejected the gospel of St John. The word is compounded of the privative *α* and *λογος*, q. d. *Without Logos or Word*. Some ascribe the origin of the name, as well as of the sect of Alogians, to Theodore of Byzantium, by trade a currier; who having apostatized under the persecution of the emperor Severus, to defend himself against those who reproached him therewith, said, that it was not God he denied, but only man. Whence his followers were called in Greek *αλογοι*, because they rejected the Word. But others, with more probability, suppose the name to have been first given them by Epiphanius in the way of reproach. They made their appearance toward the close of the second century.

ALOGOTROPHIA, among physicians, a term signifying the unequal growth or nourishment of any part of the body, as in the rickets.

ALOOF, has frequently been mentioned as a sea-term: but whether justly or not, we shall not presume to determine. It is known in common discourse to imply *at a distance*; and the resemblance of the phrases *keep aloof*, and *keep a luff*, or *keep the luff*, in all probability gave rise to the conjecture. If it was really a

Alnwick
||
Aloof.

aloof
||
Alp Arslan.

sea-phrase originally, it seems to have referred to the dangers of a lee-shore, in which situation the pilot might naturally apply it in the sense commonly understood, viz. keep *all off*, or quite off: it is, however, never expressed in that manner by seamen now. See *LUFF*. It may not be improper to observe, that besides using this phrase in the same sense with us, the French also call the weather-side of a ship, and the weather-cluc of a course, *le lof*.

ALOPECE, **ALOPECIA**, in *Ancient Geography*, an island placed by Ptolemy at the mouth of the Tanais, and called the island *Tanais*, now *l'Isle des Renards*. (Baudrand). Also an island of the Bosphorus Cimmerius (Pliny); and another in the Ægean sea, over against Smyrna.

ALOPECE, a term used among physicians to denote a total falling off of the hair from certain parts, occasioned either by the defect of nutritious juice, or by its vicious quality corroding the roots of it, and leaving the skin rough and colourless.

The word is formed from *αλωπηξ*, *vulpes*, "a fox;" whose urine, it is said, will occasion baldness, or because it is a disease which is common to that creature. It is directed to wash the head every night at going to bed with a ley prepared by boiling the ashes of vine branches in red wine. A powder made by reducing hermodactyls to fine flour is also recommended for the same purpose.

In cases where the baldness is total, a quantity of the finest burdock roots are to be bruised in a marble mortar, and then boiled in white wine until there remains only as much as will cover them. This liquor, carefully strained off, is said to cure baldness, by washing the head every night with some of it warm. A ley made by boiling ashes of vine branches in common water is also recommended with this intention. A fresh cut onion, rubbed on the part until it be red and itch, is likewise said to cure baldness.

A multitude of such remedies are everywhere to be found in the works of Valescus de Taranta, Rondeletius, Hallerius, Trincavellius, Celsus, Senertay, and other practical physicians.

ALOPECURUS, or **FOXTAIL-GRASS**. See **BOTANY Index**.

ALOPEX, in *Zoology*, a species of the canis, with a straight tail and black tip. It is commonly called the *field fox*.

ALOSA, the shad, or mother of herrings, a species of the clupea. See **CLUPEA**, **ICHTHYOLOGY Index**.

ALOST, a town in Flanders, and in the kingdom of the Netherlands, situated on the river Dender, in the midway between Brussels and Ghent. Here was formerly a convent of Carmelites, another of Capuchines, another of barefooted Carmelites, three nunneries, an hospital, and a convent of Guillemins, in which is the tomb of Theodore Martin, who brought the art of printing out of Germany into the Low Countries. Alost was taken and dismantled by Marshal Turenne in 1667; and after the battle of Ramillies in 1706, was abandoned to the allies. The population by the last census amounted to 10,926, a great proportion of whom trade in corn and hops, or are engaged in brewing. E. Long. 3. 56. N. Lat. 49. 55.

ALP ARSLAN, the second sultan of the dynasty of Seljuk in Persia, was the son of David, and great

grandson of Seljuk the founder of the dynasty. He was born in the year 1030, of the Hegira 421. In place of Israel, which was his original name, he assumed that of Mohammed, when he embraced the Mussulman faith, and he obtained the surname *Alp Arslan*, which in the Turkish language signifies a *valiant lion*, on account of his military prowess. Having held the chief command in Khorasan for ten years as lieutenant of his uncle Togrul Beg, he succeeded him in the year 1063, and at the commencement of his reign saw himself sole monarch of Persia, from the river Amu to the Tigris. When he assumed the reins of government, faction and open rebellion prevailed in his dominions, in subduing of which he was ably assisted by Nadham al Molk his visir, one of the most distinguished characters of his time, whose prudence and integrity in the administration of the affairs of the kingdom proved of most essential service to this prince and to his successor. Peace and security being established in his dominions, he convoked an assembly of the states; and having declared his son Malek Shaw his heir and successor, seated him on a throne of gold, and exacted an oath of fidelity to him from the principal officers of the empire. With the hope of acquiring immense booty in the rich temple of St Basil in Cæsarea, the capital of Cappadocia, he placed himself at the head of the Turkish cavalry, crossed the Euphrates, and entered and plundered that city. He then marched into Armenia and Georgia, which in the year 1065 he finally conquered. In the former country, the very name of a kingdom and the spirit of a nation were totally extinguished. But the native Georgians, who had retired to the woods and valleys of Mount Caucasus, made a more vigorous resistance. They too, however, overpowered by the arms of the sultan and his son Malek, were forced to submission, and reduced to slavery. To punish them for the brave defence which they had made, and as a badge of their humiliating condition, Alp Arslan obliged them to wear at their ears horse shoes of iron. Some, to escape this mark of cruelty and ignominy, professed to embrace the religion of Mahomet.

In the year 1068 Alp Arslan invaded the Roman empire, the seat of which was then at Constantinople. Eudocia, the reigning empress, saw and dreaded the progress of his arms. To avert the threatened danger, she married Romanus Diogenes, a brave soldier, who was accordingly associated with her in the government, and raised to the imperial dignity. The new emperor, during the exhausted state of their resources, sustained the Roman power with surprising valour and invincible courage. His spirit and success animated his soldiers in the field to act with fortitude and firmness, inspired his subjects with hope, and struck terror in his enemies. In three severe campaigns his arms were victorious; and the Turks were forced to retreat beyond the Euphrates. In the fourth he advanced with an army of 100,000 men into the Armenian territory for the relief of that country. Here he was met by Alp Arslan with 40,000 cavalry, or according to some authors, a much smaller number; and the sultan having proposed terms of peace, which were insultingly rejected by the emperor, a bloody and decisive engagement took place. Alp Arslan, it is said, when he saw that a battle was inevitable, wept at the thought that so many of his faithful followers must fall

^{Alp Arslan.} in the struggle; and after offering up a devout prayer, granted free permission to all who chose it to retire from the field. Then with his own hand he tied up his horse's tail, exchanged his bow and arrows for a mace and scymitar, and robing himself in a white garment perfumed with musk, resolved to perish on the spot unless he came off victorious. The skilful movements of the Turkish cavalry soon made an impression on the superior numbers of the Greeks, who were thrown into great disorder, and after a terrible slaughter, were totally routed. Romanus, deserted by the main body of his army, with unshaken courage kept his station, till he was recognised by a slave, taken prisoner, and conducted into the presence of Alp Arslan. In the Turkish divan, the captive emperor was commanded to kiss the ground as a degrading mark of submission to the power and authority of the sultan, who, it is said, leapt from his throne and set his foot on his neck. But this is scarcely probable or consistent with the generous and respectful treatment which he otherwise experienced. For the sultan instantly raised him from the ground, embraced him tenderly, and assured him that his life and dignity should remain inviolate under the protection of a prince who had not forgotten the respect due to the majesty of his equals, and the vicissitudes of fortune. When the terms of his ransom were about to be settled, Romanus was asked by Alp Arslan what treatment he expected to receive. To this question the emperor, with seeming indifference, replied, "If you are cruel, you will take my life; if you follow the dictates of pride, you will drag me at your chariot wheels: if you consult your interest, you will accept a ransom, and restore me to my country." "But what," says the sultan, "would you have done in such circumstances?" "Had I been victorious," said the insolent Romanus, "I would have inflicted on thy body many a stripe." The conqueror smiled at the fierce and unsubdued spirit of his captive; observed that the Christian precepts strongly inculcated the love of enemies and the forgiveness of injuries; and, with a noble greatness of mind, declared that he would never imitate an example which he disapproved. A ransom of a million, an annual tribute of 3000 pieces of gold, an intermarriage between the families, and the deliverance of all the captive Mussulmans in the power of the Greeks, were at last agreed to as the terms of peace and the liberty of the emperor. Romanus was now dismissed loaded with presents, and respectfully attended by a military guard. But the distracted state of his dominions, the consequence of a revolt of his subjects, precluded him from fulfilling the terms of the treaty, and remitting the stipulated price of his ransom. The sultan seemed disposed to favour and support the declining fortunes of his ally; but the defeat, imprisonment, and death of Romanus interrupted the accomplishment of his generous, or rather ambitious, design.

At this time the dominion of Alp Arslan extended over the fairest part of Asia; 1200 princes, or sons of princes, surrounded his throne; and 200,000 soldiers were ready to execute his commands. He now meditated a greater enterprise, and declared his purpose of attempting the conquest of Turkestan, the original seat of his ancestors. After great preparations for the expedition, he marched with a powerful army, and arrived

at the banks of the Oxus. Before he could pass the river with safety, it was necessary to gain possession of some fortresses in its vicinity; one of which was for several days vigorously defended by the governor, Joseph Cothual, a Carizmian. He was, however, obliged to surrender, and was carried a prisoner before the sultan, who, being enraged at his obstinacy and presumption, addressed him in very reproachful terms. Joseph replied with so much spirit, that he roused the resentment of Alp Arslan, and was commanded instantly to be fastened by the hands and feet to four stakes, to suffer a painful and cruel death. Joseph, on hearing this sentence, became furious and desperate; and drawing a dagger which he had concealed in his boots, rushed towards the throne to stab the sultan; the guards raised their battle-axes, and moved forward to defend their sovereign; but Alp Arslan, the most expert archer of his age, checking their zeal, forbade them to advance, and drew his bow: his foot slipped, and the arrow missed Joseph, who rushed forward, and plunging his dagger in the breast of the sultan, was himself instantly cut in pieces. The wound proved mortal, and the sultan expired in a few hours after he received it, in the year 1072. When he found his end approaching, he addressed himself in these words to his attendants: "In my youth," said he, "I was advised by a wise man to humble myself before God, never to confide in my own strength, or to despise the most contemptible enemy. These lessons I have neglected, for which I have now met deserved punishment. Yesterday, when I beheld from an eminence the number and discipline of my troops, I said in the confidence of my heart, 'What power on earth can oppose me? what man dares to attack me?' To day, vainly trusting to my own strength and dexterity, I foolishly checked the prompt zeal and alacrity of my guards for my safety, and now I have fallen by the hand of an assassin? But I perceive that no force or address can resist fate." He died in the 10th year of his reign, at the age of 44. He was buried at Maru, one of the four cities of Khorasan, the tomb of the Seljukian dynasty. On his tomb was inscribed the following epitaph; "All you who have beheld the grandeur of Alp Arslan exalted to the heavens, come to Maru, and you will see it buried in the dust."

This prince was distinguished for his valour, liberality, and piety. He was patient, just, and sincere. His stature, aspect, and voice, commanded the respect of all who approached him. He had long whiskers, and usually wore a high turban in the form of a crown. He was succeeded by his son Malek Shah, who had been proclaimed and acknowledged sultan of the Turks during his life. (*Mod. Univ. Hist. Gibbon's Hist.*)

ALPHA, the name of the first letter of the Greek alphabet, answering to our A. As a numeral, it stands for one, or the first of any thing. It is particularly used, among ancient writers, to denote the chief or first man of his class or rank. In this sense, the word stands contradistinguished from *beta*, which denotes the second person. Plato was called the *Alpha* of the wits: Eratosthenes, keeper of the Alexandrian library, whom some called a *Second Plato*, is frequently named *Beta*.

ALPHA is also used to denote the beginning of any thing. In which sense it stands opposed to *omega*, which

Alpha
Alphabet.

which denotes the end. And these two letters were made the symbol of Christianity; and accordingly were engraven on the tombs of the ancient Christians, to distinguish them from those of idolaters. Moralez, a Spanish writer, imagined that this custom only commenced since the rise of Arianism; and that it was peculiar to the orthodox, who hereby made confession of the eternity of Christ: but there are tombs prior to the age of Constantine whereon the two letters were found, besides that the emperor just mentioned bore them on his labarum before Arius appeared.

ALPHABET, the natural or customary series of the several letters of a language (see LANGUAGE and WRITING). The word is formed from *alpha* and *beta*, the first and second letters of the Greek alphabet. The number of letters is different in the alphabets of different languages. The English alphabet contains 24 letters; to which if we add *j* and *v* consonant, the sum will be 26: the French contains 23; the Hebrew, Chaldee, Syriac, and Samaritan, 22 each; the Arabic 28; the Persian 31; the Turkish 33; the Georgian 36; the Coptic 32; the Muscovite 43; the Greek 24; the Latin 22; the Sclavonic 27; the Dutch 26; the Spanish 27; the Italian 20; the Ethiopic and Tartarian, each 22; the Indians of Bengal 21; the Barmese 19. The Chinese have, properly speaking, no alphabet, except we call their whole language by that name; their letters are words, or rather hieroglyphics, amounting to about 80,000.

It has been a matter of considerable dispute whether the method of expressing our ideas by visible symbols called *letters* be really a human invention; or whether we ought to attribute an art so exceedingly useful to an immediate revelation from the Deity.—In favour of the latter opinion it has been urged,

Arguments
for writing
being a di-
vine reve-
lation.

1. The five books of Moses are universally acknowledged to be the most ancient compositions, as well as the most early specimens of alphabetical writing we have. If, therefore, we suppose writing to be the result of human ingenuity, it must be different from all other arts, having been brought to perfection at once; as it seems impossible to make any real improvement on the Hebrew alphabet. It may indeed be replied, that alphabetical characters perhaps have existed many ages before the writings of Moses, though the more ancient specimens have perished. This, however, being a mere unsupported assertion, without any historical testimony to corroborate it, cannot be admitted as a proof. Again, Setting aside the evidence to be derived from Scripture on this subject, the simplicity of manners predominant in the early ages, the small extent of the intellectual powers of mankind, and the little intercourse which nations had with one another, which would seem more particularly to render writing necessary, can scarcely allow us to suppose that such a complex and curious contrivance as alphabetical writing could be invented by a race of men whose wants were so few, their advantages so circumscribed, and their ideas so limited.

2. If alphabetical writing were a mere human invention, it might be expected that different nations would have fallen upon the same expedient independent of each other during the compass of so many ages. But no such thing has taken place; and the writing of every people on earth may be referred to one common

original. If this can be proved, the argument from successive derivation, without a single instance of independent discovery, must be allowed to amount to the very highest degree of probability in favour of our hypothesis, which will now rest on the evidence for or against this fact; and which may be summed up in the following manner.

Among the European nations we find none who can pretend any right to the discovery of letters. All of them derived the art from the Romans, excepting only the Turks, who had it from the Arabians. The Romans never laid claim to the discovery; but confessed that they derived their knowledge from the Greeks, and the latter owned that they had it from the Phœnicians; who, as well as their colonists the Carthaginians, spoke a dialect of the Hebrew scarcely varying from the original. The Coptic, or Egyptian, resembles the Greek in most of its characters, and is therefore to be referred to the same original. The Chaldee, Syriac, and latter Samaritan, are dialects of the Hebrew, without any considerable deviation, or many additional words. The Ethiopic differs more from the Hebrew, but less than the Arabic; yet these languages have all issued from the same stock, as the similarity of their formation, and the numberless words common to them, all sufficiently evince: and the Persic is very nearly allied to the Arabic. Alterations indeed would naturally be produced, in proportion to the civilization of the several nations, and their intercourse with others; which will account for the superior copiousness of some above the rest. It appears then, that all the languages in use amongst men that have been conveyed in alphabetical characters, have been the languages of people connected ultimately or immediately with the Hebrews, who have handed down the earliest specimens of writing to posterity: and we have therefore the greatest reason to believe, that their method of writing, as well as their language, was derived from the same source.

This proposition will be farther confirmed from considering the sameness of the artificial denominations of the letters in the Oriental, Greek, and Latin languages, accompanied also by a similar arrangement, as *alpha*, *beta*, &c. It may still be objected, however, that the characters employed by the ancients to discriminate their letters are entirely dissimilar. Why should not one nation, it may be urged, adopt from the other the mode of expressing the art as well as the art itself? To what purpose did they take the trouble of inventing other characters? To this objection it may be replied, 1. From the instance of our own language, we know what diversities may be introduced in this respect merely by length of time and an intercourse with neighbouring nations. And such an effect would be more likely to take place before the art of printing had contributed to establish an uniformity of character: For when every work was transcribed by the hand, we may easily imagine how many variations would arise from the fancy of the scribe, and the mode of writing so constantly different in individuals. 2. This diversity might sometimes arise from vanity. When an individual of another community had become acquainted with this wonderful art, he might endeavour to recommend himself as the inventor; and, to avoid detection, might invent other characters. 3. The characters

Alphabet.

Alphabet.

acters of the alphabet might sometimes be accommodated as much as possible to the symbolical marks already in use amongst a particular people. These having acquired a high degree of sanctity by the use of many generations, would not easily be superseded without the aid of some such contrivance. 4. This is supported by the testimony of Herodotus; who informs us, "that those Phœnicians who came with Cadmus introduced many improvements among the Greeks, and alphabetical writing too, not known among them before that period. At first they used the Phœnician character; but in process of time, as the pronunciation altered, the standard of the letters was also changed. The Ionian Greeks inhabited at the time the parts adjacent to Phœnicia: who having received the art of alphabetical writing from the Phœnicians, used it, with an alteration of some few characters, and confessed ingenuously, that it was called Phœnician from the introducers of it." He tells us that he had himself seen the characters of Cadmus in the temple of Ismenian Apollo at Thebes in Bœotia, engraven upon tripods, and very much resembling the Ionian characters. 5. The old Samaritan is precisely the same as the Hebrew language: and the Samaritan Pentateuch does not vary by a single letter in twenty words from the Hebrew: but the characters are widely different: for the Jews adopted the Chaldaic letters during their captivity at Babylon instead of the characters of their forefathers.

3. What we know of those nations who have continued for many centuries unconnected with the rest of the world, strongly militates against the hypothesis of the human invention of alphabetical writing. The experiment has been fairly made upon the ingenuity of mankind for a longer period than that which is supposed to have produced alphabetical writing by regular gradations; and this experiment determines pre-emptorily in their favour. The Chinese, a people famous for their discoveries and mechanical turn of genius, have made some advances towards the delineation of their ideas by arbitrary signs, but have nevertheless been unable to accomplish this exquisite device; and after so long a trial to no purpose, we may reasonably infer, that their mode of writing, which is growing more intricate and voluminous every day, would never terminate in so clear, so comparatively simple, an expedient as that of alphabetical characters. The Mexicans, too, had made some rude attempts of the same kind; but with less success than the Chinese. We know also, that hieroglyphics were in use among the Egyptians posterior to the practice of alphabetical writing by the Jews; but whether the epistolography, as it is called, of the former people, which was in vogue during the continuance of the hieroglyphics, might not possibly be another name for alphabetical writing, cannot be decided.

4. We shall consider the argument on which the commonly received supposition entirely depends: that is, the natural gradation, through the several species of symbols acknowledged to have been in use with various people, terminating at last, by an easy transition, in the detection of alphabetical characters. The strength of this argument will be best understood from the following representation.

"1. The first method of embodying ideas would

be by drawing a representation of the objects themselves. The imperfection of this method is very obvious, both on account of its tediousness and its inability of going beyond external appearances to the abstract ideas of the mind.

"2. The next method would be somewhat more general, and would substitute two or three principal circumstances for the whole transaction. So two kings, for example, engaging each other with military weapons, might serve to convey the idea of a war between the two nations. This abbreviated method would be more expeditious than the former; but what it gained in conciseness would be lost in perspicuity. It is a description more compendious indeed, but still a description of outward objects alone, by drawing their resemblance. To this head may be referred the picture-writing of the Mexicans.

"3. The next advance would be to the use of symbols: the incorporation, as it were, of abstract and complex ideas in figures more or less generalized, in proportion to the improvement of it. Thus, in the earlier stages of this device, a circle might serve to express the sun, a semicircle the moon; which is only a contraction of the foregoing method. This symbol writing in its advanced state would become more refined, but enigmatical and mysterious in proportion to its refinement. Hence it would become less fit for common use, and therefore more particularly appropriated to the mysteries of philosophy and religion. Thus, two feet standing upon water served to express an impossibility; a serpent denoted the oblique trajectories of the heavenly bodies: and the beetle, on account of some supposed properties of that insect, served to represent the sun. The Egyptian hieroglyphics were of this kind.

"4. This method being still too subtle and complicated for common use, the only plan to be pursued was a reduction of the first stage of the preceding method. Thus a dot, instead of a circle, might stand for the sun; and a similar abbreviation might be extended to all the symbols. On this scheme every object and idea would have its appropriated mark: these marks, therefore, would have a multiplicity proportionable to the works of nature and the operations of the mind. This method was likewise practised by the Egyptians; but has been carried to a greater perfection by the Chinese. The vocabulary of the latter is therefore infinite, or at least capable of being extended to any imaginable length. But if we compare this tedious and awkward contrivance with the astonishing brevity and perspicuity of alphabetical writing, we must be persuaded that no two things can be more dissimilar; and that the transition from a scheme constantly enlarging itself, and growing daily more intricate, to the expression of every possible idea by the modified arrangement of four-and-twenty marks, is not so very easy and perceptible as some have imagined. Indeed this seems still to be rather an expression of things in a manner similar to the second stage of symbol writing than the notification of ideas by arbitrary signs."

To all this we shall subjoin the following remarks, which seem to give additional force to the foregoing reasoning.

"1. Pliny asserts the use of letters to have been eter-

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Additional remarks in confirmation of these arguments.

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nal; which shows the antiquity of the practice to extend beyond the era of authentic history.

"2. The cabalistical doctors of the Jews maintain, that alphabetical writing was one of the ten things which God created on the evening of the Sabbath.

"3. Most of the profane authors of antiquity ascribe the first use of alphabetical characters to the Egyptians, who, according to some, received them from Mercury; and, according to others, from their god Teuth.

"4. There is very little reason to suppose that even language itself is the effect of human ingenuity and invention."

Answers to
the above
arguments.

Thus we have stated the arguments in favour of the revelation of alphabetical writing; which are answered, by those who take the contrary side, in the following manner.

1. Moses nowhere says that the alphabet was a new thing in his time; nor does he give the least hint of his being the inventor of it. The first mention we find of *writing* is in the 17th chapter of Exodus; where Moses is commanded to *write in a book*; and which took place before the arrival of the Israelites at Sinai. This shows that writing did not commence with the delivery of the two tables of the law, as some have supposed. Neither are we to conclude that the invention had taken place only a short time before; for the *writing in a book* is commanded as a thing commonly understood, and with which Moses was well acquainted. It is plain, from the command to engrave the names of the twelve tribes of Israel upon stones *like the engravings of a signet*, that writing had been known and practised among them, as well as other nations, long before. We must also remember, that the people were commanded to write the law on their door posts, &c. so that the art seems not only to have been known, but universally practised among them. But had writing been a new discovery in the time of Moses, he would probably have commemorated it as well as the other inventions of music, &c.: Nor is there any reason to suppose that God was the immediate revealer of the art; for Moses would never have omitted to record a circumstance of such importance, as the memory of it would have been one of the strongest barriers against idolatry.

Again, Though several profane writers attribute the origin of letters to the gods, or to some divine person, yet this is no proof of its being actually revealed; but only that the original inventor was unknown. The learned bishop of Gloucester observes, that the ancients gave nothing to the gods of whose original they had any records; but where the memory of the invention was lost, as of seed-corn, wine, writing, civil society, &c. the gods seized the property, by that kind of right which gives strays to the lord of the manor.

As neither the sacred nor profane historians, therefore, have determined any thing concerning the invention of letters, we are at liberty to form what conjectures we think most plausible concerning the origin of them; and this, it is thought, might have taken place in the following manner.

"1. Men, in their rude uncultivated state, would have neither leisure, inclination, nor inducement, to cultivate the powers of the mind to a degree sufficient for the formation of an alphabet: but when a people arrived at such a pitch of civilization as required them

to represent the conceptions of the mind, which have no corporeal forms, necessity would occasion further exertions, and urge them to find out a more expeditious manner of transacting their business than by picture-writing.

"2. These exertions would take place whenever a nation began to improve in arts, manufactures, and commerce; and the greater genius such a nation had, the more improvements would be made in the notation of their language; whilst those people who had made less progress in civilization and science, would have a less perfect system of elementary characters; and perhaps advance no farther for many ages than the marks or characters of the Chinese. Hence we may see, that the business of princes, as well as the manufactures and commerce of each country, would produce the necessity of devising some expeditious manner of communicating information to one another."

The art of writing, however, is of so great antiquity, and the early history of most nations so full of fable, that it must be extremely difficult to determine what nation or people may justly claim the honour of the invention. But as it is probable that letters were the produce of a certain degree of civilization among mankind, we must therefore have recourse to the history of those nations who seem to have been first civilized.

The Egyptians have an undoubted title to a very early civilization; and many learned men have attributed the invention of letters to them. The late bishop of Gloucester contends, that Egypt was the parent of all the learning of Greece, and was resorted to by all the Grecian legislators, naturalists, and philosophers; and endeavours to prove that it was one of the first civilized countries on the globe. Their writing was of four kinds: 1. *Hieroglyphic*; 2. *Symbolic*; 3. *Epistolic*; and, 4. *Hierogrammatic*. In the most early ages they wrote, like all other infant nations, by pictures; of which some traces yet remain among the hieroglyphics of Horapollo, who informs us, that they represented a *fuller* by a man's two feet in water; *fire*, by smoke ascending, &c. But to render this rude invention less inconvenient, they soon devised the method of putting one thing of similar qualities for another.

The former was called the *curiologic*, the latter the *tropical* hieroglyphic; which last was a gradual improvement on the former. These alterations in the manner of delineating hieroglyphic figures produced and perfected another character, called the *running-hand* of the *hieroglyphics*, resembling the Chinese writing; which having been first formed by the outlines of each figure, became at length a kind of *marks*; the natural effects of which were, that the constant use of them would take off the attention from the symbol and fix it on the thing signified. Thus the study of symbolic writing would be much abbreviated; because the writer or decypherer would have then little to do but to remember the power of the symbolic mark; whereas before, the properties of the thing or animal delineated were to be learned. This, together with the other marks by institution, to denote mental conceptions, would reduce the characters to a similar state with the present Chinese; and these were properly what the ancients called *hieroglyphical*. We are informed by Dr Robert Huntingdon, in his account of the Porphyry pillars,

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Letters
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Alphabet. pillars, that there are some ancient monuments of this kind yet remaining in Egypt.

The sacred book or ritual of the Egyptians, according to Apuleius, was written partly in symbolic, and partly in these hieroglyphic characters, in the following manner: "He (the hierophant) drew out certain books from the secret repositories of the sanctuary, written in unknown characters, which contained the words of the sacred formula compendiously expressed, partly by figures of animals, and partly by certain marks or notes intricately knotted, revolving in the manner of a wheel, crowded together, and curled inward like the tendrils of a vine, so as to hide the meaning from the curiosity of the profane."

Letters not invented in Egypt. But though letters were of great antiquity in Egypt, there is reason to believe that they were not first invented in that country. Mr Jackson, in his Chronological Antiquities, has endeavoured to prove, that they were not invented or carried into Egypt by *Taaut* or *Thoth*, the first Hermes, and son of Misraim, who lived about 500 years after the deluge; but that they were introduced into that country by the second Hermes, who lived about 400 years after the former. This second Hermes, according to Diodorus, was the inventor of grammar and music, and added many words to the Egyptian language. According to the same author also, he invented letters, rhythm, and the harmony of sounds. This was the Hermes so much celebrated by the Greeks, who knew no other than himself. On the other hand, Mr Wise asserts that Moses and Cadmus could not learn the alphabet in Egypt; and that the Egyptians had no alphabet in their time. He adduces several reasons to prove that they had none till they received what was called the *Coptic*, which was introduced either in the time of the Ptolemies or under Psammitichus or Amasis; and the oldest alphabetic letters which can be produced as Egyptian, appear plainly to have been derived from the Greek. Herodotus confesses, that all he relates before the reign of Psammitichus is uncertain; and that he reports the early transactions of that nation on the credit of the Egyptian priests, on which he did not greatly depend; and Diodorus Siculus is said to have been greatly imposed upon by them. Manetho, the oldest Egyptian historian, translated the sacred registers out of Egyptian into Greek, which are said by Syncellus to have been written in the sacred letters, and to have been laid up by the second Mercury in the Egyptian temples. He allows the Egyptian gods to have been mortal men; but his history was very much corrupted by the Greeks, and hath been called in question by several writers from the account which he himself gave of it. After Cambyses had carried away the Egyptian records, the priests, to supply their loss, and to keep up their pretensions to antiquity, began to write new records; wherein they not only unavoidably made great mistakes, but added much of their own invention, especially as to distant times.

Claim of the Phœnicians. The Phœnicians have likewise been supposed the inventors of letters; and we have the strongest proofs

of the early civilization of this people. Their most ancient historian, Sanchoniatho, lived in the time of Abibalus, father of Hiram king of Tyre. He informs us, that letters were invented by *Taaut*, who lived in Phœnicia in the 12th and 13th generations after the creation. "Misor (says he) was the son of Hamyn; the son of Misor was *Taaut*, who invented the first letters for writing." The Egyptians call him *Thoth*; the Alexandrians *Thoyth*; and the Greeks *Hermes*, or *Mercury*. In the time of this *Taaut* or *Mercury*, (the grandson of Ham the son of Noah), Phœnicia and the adjacent country was governed by Uranus, and after him by his son Saturn or Cronus. He invented letters either in the reign of Uranus or Cronus; and staid in Phœnicia with Cronus till the 32d year of his reign. Cronus, after the death of his father Uranus, made several settlements of his family, and travelled into other parts; and when he came to the south country, he gave all Egypt to the god *Taautus*, that it should be his kingdom. Sanchoniatho began his history with the creation, and ended it with placing *Taautus* on the throne of Egypt. He does not mention the deluge, but makes two more generations in Cain's line from Protogonus to Agrovenus (or from Adam to Noah) than Moses. As Sanchoniatho has not told us whether *Taaut* invented letters either in the reign of Uranus or Cronus, "we cannot err much (says Mr Jackson) if we place his invention of them 550 years after the flood, or 20 years after the dispersion, and 2619 years before the Christian era, and six, or perhaps ten years, before he went into Egypt. This prince and his posterity reigned at Thebes in Upper Egypt for 15 generations.

Several Roman authors attribute the invention of letters to the Phœnicians. Pliny says (A), the Phœnicians were famed for the invention of letters, as well as for astronomical observations and novel and martial arts. Curtius informs us, that the Tyrian nation are related to be the first who either taught or learned letters: and Lucan says, that they were the first who attempted to express sounds or words by letters. Eusebius also tells us from Porphyry, that "Sanchoniatho studied with great application the writings of *Taaut*, knowing that he was the first who invented letters."

The Greeks, as we have already observed, knew no older Hermes than the second, who lived about 400 years after the Mezzite *Taaut* or *Hermes*. This second Hermes is called by Plato *Theuth*, and counsellor or sacred scribe to King *Thanus*; but it is not said that he ever reigned in Egypt: but the former *Taaut*, or *Athothes*, as Manetho calls him, was the immediate successor of Menes the first king of Egypt. This second Mercury, if we may believe Manetho, composed several books of the Egyptian history, and having improved both the language and letters of that nation, the Egyptians attributed the arts and inventions of the former to the latter. The Phœnician language is generally allowed to have been a dialect of the Hebrew; and though their alphabet does not entirely agree with the

(A) He says in another place, that the knowledge of letters is eternal. What dependence can we put in the opinion of a writer who thus contradicts himself?

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the Samaritan, yet there is a great similarity between them. Astronomy and arithmetic were much cultivated among them in the most early ages; their fine linen, purple, and glass, were much superior to those of other nations; and their extraordinary skill in architecture and other arts was such, that whatever was great, elegant, or pleasing, whether in buildings, apparel, or toys, was distinguished by the epithet of Tyrian or Sidonian; these being the chief cities of Phœnicia. Their great proficiency in learning and arts of all kinds, together with their engrossing all the commerce of the western world, are likewise thought to give them a just claim to the invention of letters.

Of the Chaldeans.

The Chaldeans also have laid claim to the invention of letters; and with regard to this, there is a tradition among the Jews, Indians, and Arabians, that the Egyptians derived their knowledge from Abraham, who was a Chaldean. This tradition is in some degree confirmed by most of the western writers, who ascribe the inventions of arithmetic and astronomy to the Chaldeans. Josephus positively asserts, that the Egyptians were ignorant of the sciences of arithmetic and astronomy before they were instructed by Abraham; and Sir Isaac Newton admits, that letters were known in the line of that patriarch for many centuries before Moses. The Chaldaic letters appear to have been derived from the Hebrew or Samaritan; which are the same, or nearly so, with the old Phœnician. Ezra is supposed to have exchanged the old Hebrew characters for the more beautiful and commodious Chaldee, which are still in use. Berosus, the most ancient Chaldean historian, who was born in the minority of Alexander the Great, does not say that he believed his countrymen to have been the inventors of letters.

Of the Syrians.

The Syrians have also laid claim to the invention of letters. It is certain indeed, that they yielded to no nation in knowledge and skill in the fine arts. Their language is said to have been the vernacular of all the oriental tongues, and was divided into three dialects. 1. The Aramean, used in Mesopotamia, and by the inhabitants of Roha and Edesa of Harram, and the Outer Syria. 2. The dialect of Palestine; spoken by the inhabitants of Damascus, Mount Libanus, and the Inner Syria. 3. The Chaldee or Nabathean dialect, the most unpolished of the three; and spoken in the mountainous parts of Assyria, and the villages of Irac or Babylonia. It has been generally believed, that no nation of equal antiquity had a more considerable trade than the Syrians: they are supposed to have first brought the commodities of Persia and India into the west of Asia; and they seem to have carried on an inland trade by engrossing the navigation of the Euphrates, whilst the Phœnicians traded to the most distant countries. Notwithstanding these circumstances, however, which might seem to favour the claim of the Syrians, the oldest characters they have are but about three centuries before Christ. Their letters are of two sorts. 1. The Estrangelo, which is the more ancient; and, 2. The Fshito, the simple or common character, which is the more expeditious and beautiful.

Of the Indians.

We must next examine the claims of the Indians, whose pretensions to antiquity yield to no other nation on earth. Mr Halhed, who has written a grammar of the Shanscrit language, informs us, that it is not only the grand source of Indian literature, but the parent,

of almost every dialect from the Persian gulf to the Chinese seas, and which is said to be a language of the most venerable antiquity. At present it is appropriated to religions records of the Bramins, and therefore shunt up in their libraries; but formerly it appears to have been current over the greatest part of the eastern world, as traces of its extent may be found in almost every district of Asia.

Mr Halhed informs us, that "there is a great similarity between the Shanscrit words and those of the Persian and Arabic, and even of Latin and Greek; and these not in technical or metaphorical terms, but in the main ground-works of language; in monosyllables, the names of numbers, and the appellations of such things as would be first discriminated on the immediate dawn of civilization. The resemblance which may be seen of the characters on the medals and signets of different parts of Asia, the light they reciprocally throw upon one another, and the general analogy which they all bear to the grand prototype, affords another ample field for curiosity. The coins of Assam, Napaul, Cashmiria, and many other kingdoms, are all stamped with Shanscrit letters, and mostly contain allusions to the old Shanscrit mythology. The same conformity may be observed in the impressions of seals from Bontan and Thibet."

The country between the Indus and Ganges still preserves the Shanscrit language in its original purity, and offers a great number of books to the perusal of the curious; many of which have been handed down from the earliest periods of human civilization.

There are seven different sorts of Indian hand-writings, all comprised under the general term of *Naagoree*, which may be interpreted *writing*. The Bramins say that letters were of divine original; and the elegant Shanscrit is styled *Daeb-naagoree*, or the writings of the Immortals, which might not improbably be a refinement from the more simple *Naagoree* of former ages. The Bengal letters are another branch of the same stock. The Bramins of Bengal have all their Shanscrit books copied in their national alphabet, and they transpose into them all the *Daeb-naagoree* manuscripts for their own perusal. The Moorish dialect is that species of Hindostanic which we owe to the conquests of the Mahometans.

The Shanscrit language contains about 700 radical words; the fundamental part being divided into three classes, viz. 1. *Dhaat*, or roots of verbs; 2. *Shudd*, or original nouns; 3. *Erya*, or particles. Their alphabet contains 50 letters; viz. 34 consonants and 16 vowels. They assert that they were in possession of letters before any other nation in the world; and Mr Halhed conjectures, that the long-boasted original civilization of the Egyptians may still be a matter of dispute. The rajah of Kishinagur affirms, that he has in his possession Shanscrit books, where the Egyptians are constantly described as disciples, not as instructors; and as seeking in Hindostan that liberal education, and those sciences, which none of their own countrymen had sufficient knowledge to impart. Mr Halhed hints also, that the learning of Hindostan might have been transplanted into Egypt, and thus have become familiar to Moses. Several authors, however, are of opinion, that the ancient Egyptians possessed themselves of the trade of the East by the Red sea, and that they carried

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carried on a considerable traffic with the Indian nations before the time of Sesostri; whom they suppose to have been cotemporary with Abraham, though Sir Isaac Newton conjectures him to have been the Shishak who took Jerusalem in the time of Rehoboam.

In the year 1769, one of the sacred books of the Gentoos, called *Bagavadam*, translated by Meridas Poule, a learned man of Indian origin, and chief interpreter to the supreme council of Pondicherry, was sent by him to M. Berten in France. In his preface he says, that it was composed by Viassar the son of Brahma, and is of sacred authority among the worshippers of Vischnow. This book claims an antiquity of 5000 years; but M. de Guines has shown, that its pretensions to such extravagant antiquity are entirely inconclusive and unsatisfactory: whence we may conclude, says Mr Astle, that though a farther inquiry into the literature of the Indian nations may be laudable, yet we must by no means give too easy credit to their relations concerning the high antiquity of their manuscripts and early civilization.

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It is not pretended that the Persians had any great learning among them till the time of Hystaspes the father of Darius. The former, we are told, travelled into India, and was instructed by the Bramins in the sciences for which they were famed at that time. The ancient Persians despised riches and commerce, nor had they any money among them till after the conquest of Lydia. It appears by several inscriptions taken from the ruins of the palace of Persepolis, which was built near 700 years before the Christian era, that the Persians sometimes wrote in perpendicular columns like the Chinese. This mode of writing was first made use of on the stems of trees, pillars, or obelisks. As for those simple characters found on the west side of the staircase of Persepolis, some have supposed them to be alphabetic, some hieroglyphic, and others antediluvian. Dr Hyde pronounces them to have been mere whimsical ornaments, though the author of *Conjectural Observations on Alphabetic Writing* supposes them to be fragments of Egyptian antiquity brought by Cambyes from the spoils of Thebes. The learned are generally agreed, that the Persians were later in civilization than many of their neighbours; and they are not supposed to have any pretensions to the invention of letters.

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abians.

As the Arabians have been in possession of the country they now inhabit for upwards of 3700 years, without being intermixed with foreign nations, or subjugated by any other power, their language must be very ancient. The two principal dialects of it were that spoken by the Hamyarites and other genuine Arabs; and that of the Koreish, in which Mahomet wrote the Alcoran. The former is named by oriental writers, the *Arabic of Hamyar*; the latter, the *pure* or *defecated Arabic*. Mr Richardson observes, as a proof of the richness of this language, that it consists of 2000 radical words.

The old Arabic characters are said to have been of very high antiquity; for Ebn Hashem relates, that an inscription in it was found in Yaman as old as the days of Joseph. Hence some have supposed, that the Arabians were the inventors of letters; and Sir Isaac Newton is of opinion, that Moses learned the alphabet from the Midianites, who were Arabians.

The alphabet of the Arabs consists of 28 letters

similar to the ancient Cufic, in which the first copies of the Alcoran were written. The present Arabic characters were formed by Ebn Moklah, a learned Arabian, who lived about 300 years after Mahomet. The Arabian writers themselves inform us that their alphabet is not very ancient, and that they received it only a short time before the introduction of Islamism.

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On this account of the pretensions of different nations to the invention of letters, Mr Astle makes the following reflections: "The vanity of each nation induces them to pretend to the most early civilization: but such is the uncertainty of ancient history, that it is difficult to determine to whom the honour is due. It should seem, however, that the contest may be confined to the Egyptians, the Phœnicians, and the Chaldeans. The Greek writers, and most of those who have copied them, decide in favour of Egypt, because their information is derived from the Egyptians themselves. The positive claim of the Phœnicians does not depend entirely upon the testimony of Sanchoniatho; the credit of his history is also well supported by Philo of Byblus his translator, Porphyry, Pliny, Curtius, Lucan, and other ancient writers, who might have seen his works entire, and whose relations deserve at least as much credit as those of the Egyptian and Greek writers. It must be allowed, that Sanchoniatho's history contains many fabulous accounts; but does not the ancient history of the Egyptians, the Greeks, and most other nations, abound with them to a much greater degree? The fragments which we have of this most ancient historian are chiefly furnished by Eusebius, who took all possible advantages to represent the Pagan writers in the worst light, and to render their theology absurd and ridiculous.

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Phœnicia.

"The Phœnician and Egyptian languages are very similar; but the latter is said to be more large and full, which is an indication of its being of a later date. The opinion of Mr Wise, however, that the ancient Egyptians had not the knowledge of letters, seems to be erroneous; as they had commercial intercourse with their neighbours the Phœnicians, they probably had the knowledge of letters, if their policy, like that of the Chinese at this day, did not prohibit the use of them.

"The Chaldeans, who cultivated astronomy in the most remote ages, used symbols or arbitrary marks in their calculations; and we have shewn that these were the parents of letters. This circumstance greatly favours their claim to the invention: because Chaldea, and the countries adjacent, are allowed by all authors, both sacred and profane, to have been peopled before Egypt; and it is certain, that many nations said to be descended from Shem and Japheth, had their letters from the Phœnicians, who were descended from Ham.

"It is observable that the Chaldeans, the Syrians, Phœnicians, and Egyptians, all bordered upon each other; and as the Phœnicians were the greatest as well as the most ancient commercial nation, it is very probable that they communicated letters to the Egyptians, the ports of Tyre and Sidon being not far distant from each other.

"Mr Jackson is evidently mistaken when he says that letters were invented 2619 years before the birth of Christ. The deluge recorded by Moses was 2349 years

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years before that event; and if letters were not invented till 550 years after, as he asserts, we must date their discovery only 1799 years before the Christian era, which is 410 years after the reign of Menes, the first king of Egypt, who, according to Syncellus and others, is said to have been the same person with the Misor of Sanchoniatho, the Mizraim of the Scriptures, and the Osiris of the Egyptians; but whether this be true or not, Egypt is frequently called in Scripture *the land of Mizraim*.

"This Mizraim, the second son of Amyn or Ham, seated himself near the entrance of Egypt at Zoan, in the year before Christ 2188, and 160 years after the flood. He afterwards built Thebes, and some say Memphis. Before the time that he went into Egypt, his son Taaut had invented letters in Phœnicia; and if this invention took place ten years before the migration of his father into Egypt, as Mr Jackson supposes, we may trace letters as far back as the year 2178 before Christ, or 150 years after the deluge recorded by Moses; and beyond this period, the written annals of mankind, which have been hitherto transmitted to us, will not enable us to trace the knowledge of them; though this want of materials is no proof that letters were not known until a century and a half after the deluge. As for the pretensions of the Indian nations, we must be better acquainted with their records before we can admit of their claim to the first use of letters; especially as none of their manuscripts of any great antiquity have as yet appeared in Europe. That the Arabians were not the inventors of letters, has appeared by their own confession. Plato somewhere mentions Hyperborean letters very different from the Greek; these might have been the characters used by the Tartars, or ancient Scythians.

Of antediluvian writing.

"It may be expected that something should be said concerning those books mentioned by some authors to have been written before the deluge. Amongst others, Dr Parsons, in his *Remains of Japheth*, p. 346, 359, supposes letters to have been known to Adam; and the Sabæans produce a book, which they pretend was written by Adam. But concerning these we have no guide to direct us any more than concerning the supposed books of Enoch; some of which, Origen tells us, were found in Arabia Felix, in the dominions of the queen of Saba. Tertullian affirms, that he saw and read several pages of them: and, in his treatise *De Habitu Mulierum*, he places those books among the canonical: but St Jerome and St Austin look upon them to be apocryphal. William Postellus pretended to compile his book, *De Originibus*, from the book of Enoch; and Thomas Bangius published at Copenhagen, in 1657, a work which contains many singular relations concerning the manner of writing among the Antediluvians, which contains several pleasant stories concerning the books of Enoch.

"With regard to this patriarch, indeed, St Jude informs us that he *prophesied*, but he does not say that he *wrote*. The writings, therefore, attributed to the Antediluvians, must appear quite uncertain; though it

might be improper to assert that letters were unknown before the deluge recorded by Moses."

Alphabet.

Our author proceeds to show, that all the alphabets in the world cannot be derived from one original; because there are a variety of alphabets used in different parts of Asia, which vary in name, number, figure, order, and power, from the Phœnician, ancient Hebrew, or Samaritan. In several of these alphabets also, there are marks for sounds peculiar to the languages of the East, which are not necessary to be employed in the notation of the languages of Europe.

All the alphabets in the world cannot be proved to arise from one original.

None of the alphabets to the east of Persia have any connexion with the Phœnician or its derivatives, except where the Arabic letters have been introduced by the conquests of the Mahometans. The foundation of all the Indian characters are those called *Shanscrit* or *Sungscrit*. This signifies something brought to perfection, in contradistinction to *Prakrit*, which signifies vulgar or unpolished. Hence the refined and religious language and characters of India are called *Sungscrit*, and the more vulgar mode of writing and expression *Prakrit*. From this Shanscrit are derived the sacred characters of Thibet, the Cashmirian, Bengalese, Malabaric, and Tamoul; the Cingalese, Siamese, Mahrattan, Concanee, &c. From the same source we may derive the Tangitic or Tartar characters, which are similar in their great outlines to the Shanscrit; though it is not easily determined which is derived from the other. The common Tartar is generally read, like the Chinese, from top to bottom.

There are, however, several alphabets used in different parts of Asia, entirely different not only from the Shanscrit and all those derived from it, but also from the Phœnician and those which proceed from it. Some of these are the alphabet of Pegu, the *Batta* characters used in the island of Sumatra, and the *Barman* or *Boman* characters used in some parts of Pegu. The names and powers of the letters of which these alphabets are composed, differ entirely from the Phœnician, or those derived from them. It is impossible to assimilate their forms; and indeed it is by no means easy to conceive how the 50 letters of the Shanscrit language could be derived from the Phœnician alphabet, which consisted originally only of 13; though it is certain, that by far the greater number of alphabets now in use are derived from the ancient Hebrew, Phœnician, or Samaritan.

Mr Astle next proceeds to consider what alphabets are derived from the Phœnician. These he supposes to have been immediately the ancient Hebrew or Samaritan; the Chaldaic; the Bastulian (A) or Spanish Phœnician; the Punic, Carthaginian, or Sicilian; and the Pelasgian. From the ancient Hebrew proceeded the Chaldaic or square Hebrew; the round Hebrew; and what is called the *running hand of the Rabbins*. Thé Pelasgian gave birth to the Etruscan, Eugubian or Umbrian, Oscan, Samnic, and Ionic Greek, written from the left. From the Chaldaic or square Hebrew are derived the Syriac, and the ancient and modern Arabic. The Syriac is divided into the Estrangelo and

Alphabets derived from the Phœnician.

(A) The Bastuli are said to have been a Canaanitish or Phœnician people who fled from Joshua, and settled afterwards in Spain.]

Alphabet. and Mendæan, and the modern Arabic has given rise to the Persian and Turkish. From the ancient Arabic are derived the Cufic or Oriental, the Mauritanic or Occidental, the African or Saracen, and the Moorish. The Ionic Greek gave rise to the Arcadian, Latin, ancient Gaulish, ancient Spanish, ancient Gothic, Coptic, Ethiopic, Russian, Illyrian or Slavonic, Bulgarian, and Armenian. From the Roman are derived the Lombardic, Visigothic, Saxon, Gallican, Franco-Gallic or Merovingian, German, Caroline, Capetian, and modern Gothic.

The Punic letters are also called *Tyrian*, and were much the same with the Carthaginian or Sicilian. The Punic language was at first the same with the Phœnician; it is nearly allied to the Hebrew, and has an affinity with the Chaldee and Syriac. Some remains of it are to be met with in the Maltese. To make a complete Punic, Carthaginian, or Sicilian alphabet, we must admit several pure Phœnician letters.

The Pelasgi were likewise of Phœnician original; and, according to Sanchoniatho, the Dioscouri and Cabiri wrote the first annals of the Phœnician history, by order of Taaut, the inventor of letters. They made ships of burthen; and being cast upon the coast near Mount Casius, about 40 miles from Pelusium, where they built a temple in the second generation after the deluge related by Moses, they were called *Pelasgi*, from their passing by sea, and wandering from one country to another. Herodotus informs us, that the Pelasgi were descendants of the Phœnician Cabiri, and that the Samothracians received and practised the Cabiric mysteries from them. The Pelasgic alphabet prevailed in Greece till the time of Deucalion, when the Pelasgi were driven out of Thessaly or Oenotria by the Hellenes; after which some of them settled at the mouth of the Po, and others at Croton, now *Cortona* in Tuscany. Their alphabet consisted of 16 letters, and the Tyrrhenian alphabet, brought into Italy before the reign of that prince, consisted of no more than 13. Deucalion is said to have reigned about 820 years after the deluge, and 1526 before the Christian era.

That the Tyrrheni, Tyrseni or Etrusci, settled in Italy long before this period, appears from the testimony of Herodotus, who informs us, that a colony went by sea from Lydia into Italy under Tyrrhenus; and Dionysius of Halicarnassus proves that many authors called them Pelasgi. He then cites Hellanicus Lesbicus, an author somewhat more ancient than Herodotus, to prove, that they were first called *Pelasgi Tyrrheni*; and when they passed into Italy, they settled in that part of it called *Etruria*. Their emigration took place about the year of the world 2011, or 1993 years before the Christian era, which is 350 years before the Pelasgi left Greece. Bishop Cumberland adduces many proofs to show that the Tyrrhenians originally came out of Lydia into Italy. Several Roman authors also speak of this Lydian colony; and Horace compliments his patron Mæcenas upon his Lydian descent:

*Lydorum quicquid Etruscos
Incoluit fines, nemo generosior est te.*

The Etruscan letters are Pelasgic, and several of the Etruscan inscriptions are written in the Pelasgic language. The Roman letters are Ionic. The Oscan

language was a dialect of the Etruscan; their characters are nearer the Ionic or Roman than the Etruscan. There is also very little difference between the Pelasgian, Etruscan, and most ancient Greek letters, which are placed from right to left. The Arcadians were ancient Greeks, and used the Ionic letters; but at what time they began to write from left to right is not known, as their chronology is very uncertain. The Etruscan, Oscan, and Samnite alphabets, are derived from the Pelasgic: they differ from each other more in name than in form; but a far greater number are derived from the Ionic Greek, namely, the Arcadian, the Latin or Roman, and the others already enumerated.—The Runic is immediately derived from the Gothic.

According to Dionysius of Halicarnassus, the first Greek colony which came into Italy consisted of Arcadians, under the conduct of Oenotrus, the son of Lycaon, and fifth in descent from Phoroneus, the first king of Argos, who reigned about 599 years before the taking of Troy, and 1750 years before the Christian era. These Oenotrians were called *Aborigenes*; and after they had been engaged for many years in a war with the Siculi, entered into an alliance with a colony of the Pelasgi, who came out of Thessaly into Italy, after having been driven from the former country. About 1476 B. C. another colony of the Pelasgi, who had been driven out of Thessaly by the Curetes and Leleges, arrived in Italy, where they assisted the Aborigines to drive out the Siculi, possessing themselves of the greatest part of the country between the Tiber and the Liris, and building several cities. Solinus and Pliny tell us, that the Pelasgi first carried letters into Italy; and the latter distinguishes between the Pelasgi and the Arcades; so the letters first carried into Italy were not the Ionic Greek, but those more ancient Pelasgic characters which the Pelasgi carried with them before Deucalion and Cadmus are said to have come into Bœotia and Thessaly. The story of Cadmus is much involved in fable; but it is agreed by most of the ancients, that the children of Agenor, viz. Cadmus, Europa, Phoenix, and Cilix, carried with them a colony, composed of Phœnicians and Syrians, into Asia Minor, Crete, Greece, and Libya, where they introduced letters, music, poetry, and other arts, sciences, and customs, of the Phœnicians.

Dionysius enumerates the following Greek colonies which came into Italy: 1. The Aborigines under Oenotrus, from Arcadia. 2. The Pelasgic colony, which came from Hœmonia or Thessaly. 3. Another Arcadian colony which came with Evander from Palantium. 4. Those who came from Peloponnesus with Hercules; and, 5. Those who came with Æneas from Troy. It is not easy to discover when the Ionic way of writing from left to right was introduced into Italy; but it is certain, that it did not universally prevail even in Greece till several ages after it was found out. The Athenians did not comply with it till the year of Rome 350; nor was it practised by the Samnites even in the 6th century of that city, or 230 years before Christ: for M. Gobelín, vol. vi. Pl. 2. gives us the Samnite alphabet of that century, wherein the letters are placed from right to left; although the Ionic way of writing prevailed in some parts of Italy in the third century of Rome. "In time (says Pliny) the tacit consent of all

Alphabet. nations agreed to use the Ionic letters. The Romans consented to this mode about the time of Tarquinius Priscus, their fifth king." The letters brought by Demaratus the Corinthian, the father of Tarquin, Mr. Wise thinks, must have been the new or Ionic alphabet, and not the same with that brought by Evander 500 years before. After the Romans had established the use of the Ionic letters, they seem not to have acknowledged the Pelasgian and Etruscan to have been Greek alphabets: the most learned of them knew none older than the Ionic, as appears from the Greek Farnese inscriptions of Herodes Atticus. This learned man, out of a regard to antiquity, caused the old orthography to be observed in the writing, and the letters to be delineated after the most antique forms that could be found; and they are plainly no other than the Ionic or right-handed characters.

See Plates XV. and XVI. for specimens of the ancient alphabets here enumerated.

The ancient Gaulish letters are derived from the Greek, and their writing approaches more nearly to the Gothic than that of the Romans: this appears by the monumental inscription of Gordian, messenger of the Gauls, who suffered martyrdom in the third century, with all his family. These ancient Gaulish characters were generally used by the people before the conquest of Gaul by Cæsar; but after that time the Roman letters were gradually introduced. The ancient Spaniards used letters nearly Greek before their intercourse with the Romans. The ancient Gothic alphabet was very similar to the Greek, and is attributed to Ulphilas, bishop of the Goths, who lived in Mæsia about 370 years after Christ. He translated the Bible into the Gothic tongue. This circumstance might have occasioned the tradition of his having invented these letters; but it is probable that these characters were in use long before this time. The Runic alphabet is derived from the ancient Gothic.

The Coptic letters are derived immediately from the Greek. Some have confounded them with the ancient Egyptian; but there is a very material difference between them. The Ethiopic alphabet is derived from the Coptic.

The alphabet proceeding from that of the Scythians established in Europe, is the same with what St Cyril calls the *Servien*. The Russian, Illyrian or Slavonic, and the Bulgarian, are all derived from the Greek. The Armenian letters differ very much from the Greek, from which they are derived, as well as from the Latin.

Alphabets derived from the Latin.

With regard to the alphabets derived from the Latin, the Lombardic relates to the manuscripts of Italy; the Visigothic to those of Spain; the Saxon to those of England; the Gallican and Franco-Gallic or Merovingian to the manuscripts of France; the German to those of that country; and the Caroline, Capetian, and modern Gothic, to all the countries of Europe who read Latin. The first six of these alphabets are before the age of Charlemagne, the last three posterior to it. They are more distinguished by their names than the forms of their characters; and the former indicate all of them to have been of Roman extraction. Each nation, in adopting the letters of the Romans, added a taste and manner peculiar to itself; which obviously distinguished it from the writings of all other people; whence arose the differences between

Alphabet. the writings of the Lombards, Spaniards, French, Saxons, Germans, and Goths, and all the strange terms observable in the writings of the Francic Gauls or Merovingians; and those of the Carolingians, their successors may be traced from the same source. From these distinctions the name of *national writing* was derived.

The writing of Italy was uniform till the irruption of the Goths, who disfigured it by their barbarous taste. In 569, the Lombards, having possessed themselves of all Italy, excepting Rome and Ravenna, introduced that form of writing which goes under their name; and as the popes used the Lombardic manner in their bulls, the name of *Roman* was sometimes given to it in the 11th century; and though the dominion of the Lombards continued no longer than 206 years, the name of their writing continued in Italy from the 7th to the 13th century, and then ceased; when learning having declined in that as well as in other countries, the manner of writing degenerated into the modern Gothic.

The Visigoths introduced their form of writing into Spain, after having overrun that country; but it was abolished in a provincial synod, held at Leon in 1091, when the Latin characters were established for all public instruments, though the Visigothic were used in private writings for three centuries afterwards.

The Gauls, on being subjected by the Romans, adopted their manner of writing; but by subsequent additions of their own, their characters were changed into what is called the *Gallican* or *Roman Gallic* mode. This was changed by the Franks into the *Franco-Gallic* or *Merovingian* mode of writing, being practised under the kings of the Merovingian race. It took place towards the close of the sixth century, and continued till the beginning of the ninth.

The German mode of writing was improved by Charlemagne; and this improvement occasioned another distinction in writing, by introducing the alphabet named *Caroline*, which declined in the 12th century, and was succeeded in the 13th by the modern Gothic. In France it had degenerated by the middle of the 10th century, but was restored in 987 by Hugh Capet, whence it obtained the name of *Capetian*. It was used in England, as well as Germany and France.

The modern Gothic, which spread itself all over Europe in the 12th and 13th centuries, is improperly named, as not deriving its origin from the writing anciently used by the Goths. It is, however, the worst and most barbarous way of writing, and originated among the schoolmen in the decline of the arts; being indeed nothing else than Latin writing degenerated. It began in the 12th century, and was in general use, especially among monks and schoolmen, in all parts of Europe, till the restoration of arts in the 15th century, and continued longer in Germany and the northern nations. Our statute books are still printed in Gothic letters. The most barbarous writing of the seventh, eighth, and ninth centuries, was preferable to the modern Gothic. It is diversified in such a manner as can scarce admit of description; and the abbreviations used by the writers were so numerous, that it became very difficult to read it; which was one of the great causes of the ignorance of those times. Along with this, however,

Alphabet. however, the Lombardic, Gothic, Roman, Caroline, and Capetian modes of writing, were occasionally used by individuals.

The idea that all the alphabets above mentioned are derived from the Roman, tends to prove the distinction of national writing, and is of great use in discovering the age of manuscripts: for though we may not be able exactly to determine the time when a manuscript was written, we may be able nearly to ascertain its age. For example, if a writing is Merovingian, it may be declared not to be posterior to the 9th, nor prior to the 5th, century. If another be Lombardic, it may be affirmed to be posterior to the middle of the 9th, and prior to the 13th. Should it be Saxon, it cannot be of an earlier date than the 7th, nor later than about the middle of the 12th.

letters could not take place at from a recomposition of language. Having considered whence the alphabets now in use throughout the various nations of the world are derived, it remains to say something concerning them as the elements of words, or how far they are capable of expressing those sounds which, by proper combination and arrangement, constitute articulate language. The number of simple sounds in any language cannot be very numerous; and it is plainly these simple sounds alone that we have occasion to represent by alphabetical characters. Hence the person who first invented letters must have been capable of analyzing language in a manner which seems by no means easy to do, and concerning which even the learned among ourselves are not yet agreed. It is this difficulty which has produced the great diversity in the number of alphabetical characters used by different nations; and where we see a vast number of them used, we may account the writing not the better, but much the worse for it; and whoever the pretended inventor was, it is more reasonable to suppose that he disfigured an alphabet already invented, by unnecessary additions, than that he was the author of one himself.

probably at the result of a progressive evolution of the human powers. When we consider alphabetical characters as thus resulting from an analysis of language, it will by no means appear probable that it was derived from a gradual and progressive operation of the human mind through many ages. There is not the least affinity betwixt representing any object by a picture and finding out the sounds which compose the word by which it is expressed: nor, though a nation had been in use to represent things either in this method, or by any kind of arbitrary marks, for thousands of years, could the one ever have led to the other. Arbitrary marks must always be the same with pictures in this respect; that they must always be fixed to particular objects, and thus be increased *ad infinitum*. Letters, on the other hand, are indifferent to all objects; and therefore, by their combinations, which are more numerous than as many arbitrary marks as we could remember, may express all the objects in nature. This might furnish an argument of some strength for the divine revelation of writing, were it not that other arts, seemingly as useful, and as difficult to be invented, had not been expressly ascribed to particular persons whom we cannot suppose to have been divinely inspired. Thus metallurgy, music, the keeping of cattle, and use of tents, are all ascribed to a single family; and though writing be not ex-

pressly mentioned as an invention in Scripture, there is no reason to have recourse to a revelation for it, as long as the human faculties are known to have been sufficient for the invention of it. Nevertheless, if we take a review of the different arts which mankind have invented, we shall find, that few of them resulted from any gradual progress or evolution of the powers of the human mind, but rather by some sudden and almost unaccountable turn of thought in an individual. Thus, the art of printing, little inferior in its utility to that of writing, lay hid for ages, and was at last invented we scarce know how; so that if one inclined to suppose this a divine revelation, he could be at little loss for arguments to support his hypothesis. This was what all the inventions and evolutions of human powers since the creation had never been able to accomplish; yet nobody believes that it required supernatural abilities to be the author of this art, because we see plainly that it might have occurred to the human mind from various sources, and are surprised that it did not occur long before. In like manner, the method of accounting for the celestial motions by the united forces of projection and gravitation, was no result of the progress that mankind had made in science, but luckily occurred to Mr Horrox, without any thing that we know to direct him, or perhaps from causes almost unknown to himself. Thus, also, the steam engine, aerostation, &c. were suddenly invented only by a slight review of principles well known before, and which had been a thousand times overlooked by those who might have invented both. Alphabetic writing, therefore, might have been no deduction from hieroglyphic or picture writing, from which it is essentially different; and it seems to be some confirmation of this, that all nations who ever pretended to the invention of letters, have ascribed it to the labours of one particular person, without taking notice of the progress made towards it in preceding ages.

The learned author of *Hermes* informs us, that to about 20 plain elementary sounds we owe that variety of articulate voices which have been sufficient to explain the sentiments of such an innumerable multitude as all the past and present generations of men. Mr Sheridan says, that the number of simple sounds in our tongue is 28; while Dr Kenrick says, that we have only 11 distinct species of articulate sounds, which even by contraction, prolongation, and composition, are increased only to the number of 16; every syllable or articulate sound in our language being one of the number. Bishop Wilkins and Dr William Holder speak of 33 distinct sounds.

After the analysis or decomposition of language into the elementary sounds, the next step towards the notation of it by alphabetical characters, would be the delineation of a separate mark or letter to represent each sound; which marks, though few in number, would admit of such a variety of arrangements and combinations, as might be capable of producing that infinity of articulate sounds which compose language. The ingenious Wachter, in his *Naturæ et Scripturæ Concordia*, p. 64. endeavours to show, that ten marks or characters are sufficient for this purpose. His scheme is as follows:

Alphabet.

Genus.	Figura.	Potestas.
Vocal.	○	a. e. i. o. u.
Guttural.	○ 	k. c. ch. q. g. h.
Lingual.	<	l.
Lingual.	z	d. t.
Lingual.	u	r.
Dental.	□	s.
Labial.	3	b. p.
Labial.	m	m
Labial.	□	s. ph. v. w.
Nasal.	Λ	n.

If this is the case, then the most simple alphabet, which consisted only of 13 letters, must have been abundantly sufficient to answer all the purposes of mankind, and much of our twenty-four letter alphabet may appear superfluous. That able mathematician Tacquet has calculated the various combinations of the 24 letters, even without any repetition, to amount to no fewer than 620,448,401,733,239,439,360,000; while Clavius makes them only 5,852,616,738,497,664,000. Either of these numbers, however, is *infinite* to the human conceptions, and much more than sufficient to express all the sounds that ever were articulated by man. As there are more sounds in some languages than in others, it follows of course that the number of elementary characters or letters must vary in the alphabets of different languages. The Hebrew, Samaritan, and Syriac alphabets, have 22 letters; the Arabic 28; the Persian, and Egyptian or Coptic, 32; the present Russian 41; the Shanscrit 50; while the Cashmirian and Malabaric are still more numerous. The following is the scheme of the English alphabet, as given by Mr Sheridan in his *Rhetorical Grammar*, p. 9.

Number of simple sounds in our tongue 28.

3 1 2 3 2 3 1 1 1
 9 Vowels, a a a e o o e i u
 hall hat hate beer note noose bet sit but
 w y
 short oo short ee
 19 Consonants, { eb ed ef eg ek el em en ep er es
 et ev ez etl̄ eth esh ezh ing.

2 Superfluous, c, which has the power of *ek* or *ess*;
 q, that of *ek* before u.

2 Compound, j, which stands for *edzh*;
 x, for *ks* or *gz*.

1 No letter, h, merely a mark of aspiration.

2

Consonants divided into Mutes and Semivowels.

Alphabet.

6 Mutes, eb ed eg ek ep et.

3 Pure Mutes, ek ep et.

3 Impure, eb ed eg.

13 Semivowels, { ef el em en ess ev ez etl̄ eth
or liquids, { esh ezh ing.

9 Vocal, el em en er ev ez eth ezh ing.

4 Aspirated, ef ess etl̄ esh.

Divided again into

4 Labial, eb ep ev ef.

8 Dental, ed et etl̄ eth ez ess ezh esh.

4 Palatine, eg ek el er.

3 Nasal, em en ing.

Mr Sheridan observes, that our alphabet is ill calculated for the notation of the English tongue, as there are many sounds for which we have no letters or marks: and there ought to be nine more characters or letters to make a complete alphabet, in which every simple sound ought to have a mark peculiar to itself. The reason of the deficiency is, that the Roman alphabet was formerly adopted for the notation of the English language, though by no means suited to the purpose.

It now remains only to take some notice of the forms of the different letters; some knowledge of which is absolutely necessary for ascertaining the age and authenticity of inscriptions, manuscripts, charters, and ancient records. Many authors are of opinion, that letters derive their forms from the positions of the organs of speech in their pronunciation. Van Helmont has taken great pains to prove, that the Chaldaic characters are the genuine alphabet of nature; because, according to him, no letter can be rightly sounded without disposing the organs of speech into an uniform position with the figure of each letter; and in support of this system, he has anatomized the organs of articulation.

Mr Nelme has endeavoured to show, that all elementary characters or letters derive their forms from the line and the circle. His alphabet consists of 13 radical letters, four diminished and four augmented.—The radicals are L, O, S, A, B, C, D, N, U, I, E, M, R. —H, according to him, is derived from A; P from B; T from D; and F from U: these are called diminished letters. The augmented ones are, Z from S; G from C; W from U; and Y from I. He proves that his characters are very similar to those of the ancient Etruscans: but all characters are composed either of lines and circles of the former, or parts of the latter.—Mr Gebelin deduces them from hieroglyphic representations; and has given several delineations of human figures, trees, &c. in confirmation of his hypothesis.

One of the most simple alphabets has been formed by making two perpendicular and two horizontal lines:

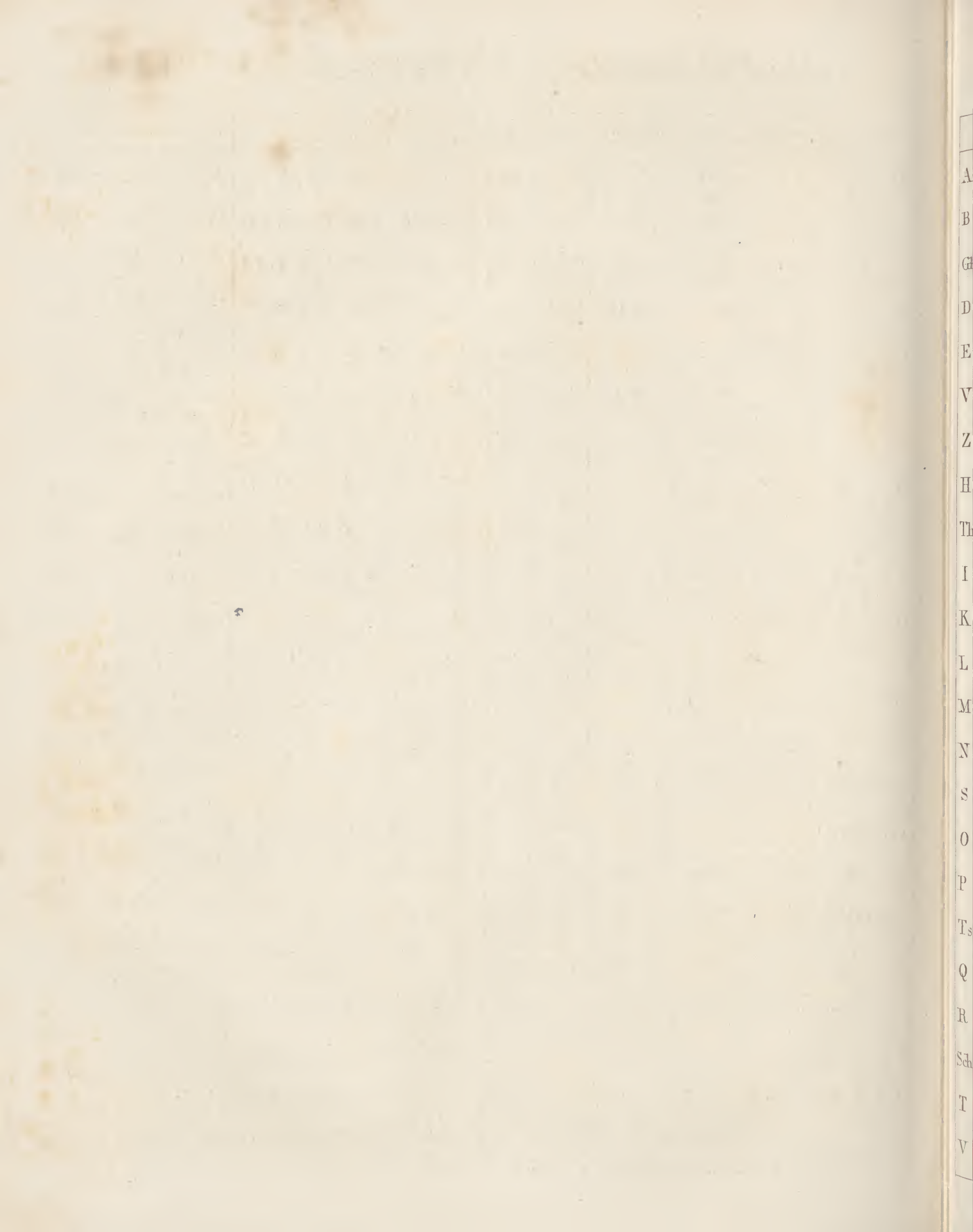
a|b|c

Thus, d|e|f. From which may be
g|h|i.

deduced nine different characters or letters: Thus,

a | b | c | d | e | f | g | h | i.

Nine



A
B
G
D
E
V
Z
H
Th
I
K
L
M
N
S
O
P
Ts
Q
R
Sch
T
V

ALPHABETA ANTIQUA.

Plate XVI.

Punicum.		Phoenician.	Oscan.	Arcadian.	Galli antiq.		Phœnicium Hebr. antiq. sive Samaritanum.	generat. Etruscorum.	
A	𐤀	𐤁𐤁𐤂	𐤃	𐤄𐤅	A	𐤆𐤇𐤈𐤉	𐤊𐤋𐤌𐤍𐤎𐤏𐤐𐤑𐤒𐤓	A	𐤔𐤕𐤖𐤗𐤘𐤙𐤚𐤛𐤜𐤝𐤞𐤟𐤠𐤡𐤢𐤣𐤤𐤥𐤦𐤧𐤨𐤩𐤪𐤫𐤬𐤭𐤮𐤯𐤰𐤱𐤲𐤳𐤴𐤵𐤶𐤷𐤸𐤹𐤺𐤻𐤼𐤽𐤾𐤿𐤿𐤿

Alphabet

Alphery.

Nine more may be made by adding a point to each,

k	l	m
n	o	p
q	r	s

and as many more as may be sufficient for the notation of any language, by adding two or more points to each character. Though these square characters are not calculated for despatch; yet they may be made as expeditiously, or more so, than the Tartar, the Bramin, the Cashmirian, or many others. Writing composed of these characters, is at first sight somewhat like the Hebrew.—Mr Dow, author of the History of Indostan, lately formed a new language and alphabet. This language, and the characters formed for its notation, were so easy, that a female of his acquaintance acquired the knowledge of them in three weeks, and corresponded with him therein during their intimacy.

New language invented by Mr Dow.

ALPHÆNIX, white barley-sugar, to which is given an extraordinary name, to render it more valuable. This sugar, which is thought good for colds, is made of common sugar, which is boiled until it becomes easy to crack, when they pour it upon a marble table, greased with oil of sweet almonds, and mould it into various figures with a brass crotchet. It is easily falsified with starch.

ALPHERY, MIKIPHER, an English divine, was born in Russia, and of the imperial line. When that country was distracted by intestine commotions, in the latter end of the 16th century, and the royal house particularly was so severely persecuted by impostors, this gentleman and his two brothers were sent over to England, and recommended to the care of Mr Joseph Bidell a Russia merchant. Mr Bidell, when they were of age fit for the university, sent them to Oxford, where the smallpox unhappily prevailing, two of them died of it. We know not whether this surviving brother took any degrees or not, but it is very probable he did, since he entered into holy orders; and in the year 1618, was presented to the rectory of Wooley in Huntingdonshire, a living of no very considerable value, being rated under 10l. in the king's books. Here he did his duty with great cheerfulness and alacrity; and although he was twice invited back to his native country by some who would have ventured their utmost to have set him on the throne of his ancestors, he chose rather to remain with his flock, and to serve God in the humble station of a parish priest. Yet in 1643, he underwent the severest trials from the rage of the fanatics; who, not satisfied with depriving him of his living, insulted him in the most barbarous manner; for, having procured a file of musqueteers to pull him out of his pulpit, as he was preaching on a Sunday, they turned his wife and small children into the street, into which they also threw his goods. The poor man in this distress raised a tent under some trees in the churchyard, over against his house, where he and his family lived for a week. One day having gotten a few eggs, he picked up some rotten wood and dry sticks, and with these made a fire in the church-porch, in order to boil them; but some of his adversaries, to show how far they could carry their rage against the church (for this poor man was so harmless they could have none against him), came and kicked about his fire, threw down his skillet, and broke his eggs.

Alphery

Alphonsin

After this, having still a little money, he made a small purchase in that neighbourhood, built a house, and lived there some years. He was encouraged to this by the Presbyterian minister, who came in his room, who honestly paid him the fifth part of the annual income of the living, which was the allowance made by parliament to ejected ministers, treated him with great humanity, and did him all the services in his power. It is a great misfortune that this gentleman's name is not preserved, his conduct in this respect being the more laudable, because it was not a little singular. Afterwards, probably on the death or removal of this gentleman, Mr Alphery left Huntingdonshire, and came and resided at Hammersmith till the Restoration put him in possession of his living again. He returned on this occasion to Huntingdonshire, where he did not stay long; for being upwards of 80, and withal very infirm, he could not perform the duties of his function. Having, therefore, settled a curate, he retired to his eldest son's house at Hammersmith, where soon after he died, much honoured and respected, and affording a remarkable instance of the vicissitudes of the world.

ALPHEUS, (Strabo); ALPHEIUS, (Ptolemy); a noted and large river of the Peloponnesus; which, rising in, and after several windings running through, Arcadia, and by Olympia in Elis, with a south-west course, falls into the Sinus Chelonites, about ten miles to the south of Olympia. It has a common spring with the Eurotas, at the foot of Mount Parthenius, near the village Asea, (Strabo). The Alpheus and Eurotas mix and run together for 20 stadia; after which, they enter a subterraneous passage at Mantinea; then again emerge, the Eurotas in Laconia, and the Alpheus in the territory of Megalopolis, (Pausanias). The poets fable strange things of this river, particularly, that out of love to the nymph *Arethusa*, it runs under the sea to Sicily, and bursts out at the fountain of that name in Syracuse, (Virgil). Its waters were reckoned good in the leprosy, which is called *Alphos*; by the Greeks; and hence the name *Alpheus*. On the banks of this river the Olympic games were celebrated, to which Pindar alludes.

"Alpheus, thy immortal flood,
On his lord's triumphant brows
The Olympic wreath bestow'd."

WEST'S PINDAR.

Pausanias adds, that the Eleans had a law, which condemned any woman to death that should either appear at the Olympic games, or even cross this river during that solemnity: and the Eleans add, that the only woman who transgressed it, had disguised herself in the habit of a master or keeper of these games, and conducted her son thither; but when she saw him come off victorious, her joy made her forget her disguise, so that her sex was discovered. She was pardoned; but from that time a law was made that the keepers should appear there naked.

ALPHONSIN, in *Surgery*, an instrument for extracting bullets out of gunshot wounds. This instrument derives its name from the inventor Alphonsus Ferrier, a physician of Naples. Its consists of three branches, which are closed by a ring. When closed and introduced into the wound, the operator draws back the ring towards the handle, upon which the branches

Alphonsin, branches opening take hold of the ball; and then the
Alphonso. ring is pushed from the haft, by which means the branches grasp the ball so firmly as to extract it from the wound.

ALPHONSO I. king of Portugal, son of Henry of Burgundy, count of Portugal, grandson of Don Alonso king of Leon and Castile, who, as the dowry of his wife Theresa, received part of the kingdom of Portugal. One Egas Munitz had the charge of his education from his father, the duties of which he executed with fidelity and success. In the year 1112 his father died, leaving him a boy only three years of age, when the reins of government and the care of the infant son fell to his mother Theresa. At the age of 18 he assumed the sovereign authority by the advice of the nobles of Portugal, who were highly offended at the growing partiality of his mother for Don Ferdinand Perez, count of Trastemara; for it was suspected that she intended to marry him. But Theresa was little disposed to resign the reins of government. Her party raised an army, which took the field to oppose the nobility who supported Alphonso; but her adherents were defeated, herself taken prisoner, and kept in confinement during the remainder of her life. Not long after his accession to the throne, his abilities both to govern and to conquer received a severe trial, in several arduous enterprises, as well against the king of Leon and Castile as against the Moorish princes, who then possessed great part of Spain and Portugal. The Moorish emperor in Barbary having sent a strong reinforcement to the princes, they were enabled to take the field with an army far superior to that of Alphonso; yet he valiantly met them in the plains of Ourique, and totally defeated their forces. Thus Providence conferred such a signal favour on the Christian arms as procured a residence for Christianity in those parts. The ambitious king of Leon and Castile assumed the title of emperor of the Spaniards, and entered Portugal to waste and destroy; but after the emperor had received a temporary check, the matter was accommodated, and he withdrew his army. In consequence of the victory obtained on the plains of Ourique, Alphonso was instantly proclaimed king; but the form and constitution of the monarchy was not settled until the nobility, prelates, and commons had assembled at Lamago for that purpose in the year 1145. The conquest of Santaren preceded this event, and was sanctioned by the unanimous concurrence of the states. The honour of crowning the king was conferred upon the archbishop of Braga; and it was legally provided; that the regal succession should descend with an uninterrupted succession to the heirs male of Alphonso. The prelates and nobility, with the concurrence of the people, instituted a code of laws consisting of 18 statutes, for the government of the kingdom. It being proposed whether it was their pleasure that the king should go to Leon and do homage to that prince or to any other, every man drawing his sword, exclaimed, "We are free, and our king is free, and we owe our liberty to our courage; and if he shall at any time submit to such an act, he deserves death, and shall not either reign over us or among us." The year after his coronation he was married to Matilda, daughter of Amadeus, count of Maurienne and Savoy; and he recovered Lisbon from the hands of the Moors,

in the year 1147. A multitude of adventurers being assembled at the mouth of the Tagus in their progress to the Holy Land, greatly assisted him in this conquest. After having added six other provinces to his dominions, he wisely began with industrious activity to regulate the affairs of his kingdom. In all his great and benevolent designs he was vigorously seconded by Matilda, a princess equally celebrated for her great beauty, mental vigour, and singular piety. With the prudence of the statesman, and the benevolence of the man, he laboured as much for the population of his acquired territories as for their increase. The conjugal felicity of this prince and princess was greatly enhanced by a numerous offspring, which enabled him, by great alliances, to strengthen his interests. His second daughter was married to Don Ferdinand, king of Leon, who notwithstanding of this alliance, ungenerously made war on his father-in-law, and took him prisoner in the field of battle; but released him, on the humiliating condition of coming in person to do homage for his dominions at Leon. In the latter part of his reign, his son Don Sancho, who inherited all his father's military talents, took the lead on several occasions; and in the year 1180, Joseph, king of Morocco, and emperor of the Almohedes, advancing with an army as far as Santaren, he there gained a glorious victory over him. Such was the consternation of the infidels, in consequence of this defeat, that they left the Portuguese at liberty to improve the interior part of the country, and to fortify their frontiers during the whole of the next year. Worn out with care and intense application, Alphonso needed repose, and had retired to Coimbra, where, after a reign of 57 years, and in the 76th year of his age, he died. In the church of the holy cross at Coimbra his remains were deposited with great funeral solemnity. He was no less than seven feet high; and his gigantic size and his martial ardour have given occasion to many absurd and incredible stories concerning his military achievements, so that, in the annals of chivalry, as well as in the records of martial exertions, he sustains a very high rank. Two orders of knighthood, that of the Wings, and that of the Avis, were instituted by him; and they still continue to flourish in that kingdom. At the age of 51, when all the faculties of the human mind are in full vigour, Don Sancho, his son, succeeded him. (*Mod. Univ. Hist.*).

ALPHONSO II. distinguished by the surname of the *Fat*, was the third king of Portugal, and succeeded his father at the age of 27 years, in 1212. His accomplished education, and his military and political talents, were tarnished by his great neglect and hatred of his brothers and sisters, which involved him in many troubles. He, however, commenced his reign with two very popular actions. The one was, sending a body of infantry to the assistance of the king of Castile, who fought with uncommon bravery in the renowned battle of Navas de Tolosa. The other was, his donation of the castle of Avis to the knights of that order, when the grand-master removed from Evora, and took up his habitation in that castle. During the life of his father, he discovered his aversion to the rest of the family, which induced him to secure the right of his children from the effects of his resentment

Alphonso. as much as in his power, by conferring upon them large sums of money and jewels, and some of the best parts of the kingdom. After the death of his father, however, Alphonso strenuously laboured to convince them that it was not in the power of his father to separate or give away any part of his dominions; but all his urgent eloquence proving unsuccessful, he had recourse to arms. The two princesses, his sisters, who had received by the grant of their father very extensive and valuable property, upon being attacked by their brother, implored the interference of the pope, and also applied to the king of Leon, to grant his protection, so that they made a very vigorous defence. The pope granted the request of the young princesses, and threatened to excommunicate Alphonso; and from Galicia, Don Ferdinand entered the dominions of Portugal to ravage and destroy; but the king prepared to defend himself against the arms of the king of Leon, and by specious pretences to evade the excommunication of the pope.

Authors are not agreed with respect to the success of this war, but it is generally supposed that, by the interference of these two powerful persons, the domestic affairs of that house were restored to a certain degree of tranquillity; however, the departure of the infant Don Ferdinand to the court of Castile, and of Don Pedro to another place, strongly indicate that the reconciliation was far from being perfect. The conduct of the king, however, produced much diversity of opinion among the common people of Portugal. Some were induced, by the arguments of the king, to conclude that it was not in the power of Don Sancho, the late king, to dismember his kingdom; and others very properly suspected the kindness of a prince to his people who displayed such uncommon and such unjustifiable hatred to his own relations; at the same time, those nobles whom the father had solemnly sworn to carry his will into execution, regarded the sacred nature of their oaths to such a degree as induced them to operate against the reigning prince.

The displeasure of the pope, however, was not to be endured. The mind of Alphonso seemed indeed to be of that quality which little regarded the displeasure or thunders of his holiness; but the effects of his threatenings were very different upon the public mind, consequently the king was constrained to seek the favour of the pope, to retain the obedience of his subjects. The king therefore sent deputies to Rome, who argued, that the crown his father wore was the purchase of the blood and valour of the Portuguese nation, and therefore not in his power to alienate; that it was a dangerous precedent, and obviously tended to subvert the sovereignty of a state; that the disuniting of the kingdom would tend to promote the cause of the infidels; and, in fine, that his disputes with his sisters had no connexion with ecclesiastical matters. The pope, however, was as well qualified to discern the nature of these specious arguments as the prince was qualified to urge them, consequently he remained unmoved; and Alphonso, in order to have the sentence of excommunication removed which had been pronounced upon him, was reluctantly induced to be reconciled to his sisters. His holiness informed of the reconciliation, with great ceremony revoked his curse and excommunication from the king and his subjects.

But the reign of this prince was destined to troubles; for no sooner was this domestic broil terminated, than the Moors rushed into the plain country in such prodigious numbers, that the king found it very difficult to repel them, or to drive them back to their own country. A favourable occurrence, however, enabled him to complete his object, by the taking of a fortress seated on a rock which was deemed impregnable, in the following manner. The Germans and Flemings had equipped an immense fleet destined for the Holy Land, consisting of 300 sail, with a numerous army on board. In consequence of tempestuous weather, their fleet was so disabled, that they were forced to put into the harbour of Lisbon to refit, just at the time when Alphonso was preparing an army to attack the Moors. The king instantly sent some of the most respectable men of his court to solicit their aid against the Moors, alleging, that it was perfectly consistent with their vows to fight against the Moors in Portugal, as well as in the Holy Land. William earl of Holland, and many other generals, were convinced by this argument, and cheerfully engaged to join him against the infidels; but about a third part of the fleet refused to join, and proceeded on their voyage. It happened, however, that they were driven by a violent storm into Italy, where they wintered. The greater part of the nobility and gentry landed under the conduct of William earl of Holland; and it was resolved that they should proceed by sea, and block up Alcaçar-do-Sal, the fortress already mentioned, while the army of Alphonso, reinforced by a considerable number, should march by land; and thus attack the place both by land and sea at once. The Moors, convinced of the importance of this place, brought an army into the field consisting of 50,000 men; but the Christians raised the siege, gave them battle, and routed them with great slaughter; and some of the chiefs of the Moors fell in the field. The fortress surrendered on the 21st of October 1217, and was conferred upon the order of St James; but notwithstanding of very urgent entreaties, the pope would not permit the army to winter in Portugal. He was desirous of having these troops and their general removed to a greater distance. The writers of that nation affirm that the soldiers experienced supernatural aid in this battle, and that the banner of the cross was actually displayed by angels.

But civil animosity succeeded to infidel war. The archbishop of Braga was highly offended that the clergy were forced to pay money and furnish troops to carry on the war against the infidels; and the people severely complained of the strictness of the laws. To chastise the rebellious clergy, the king seized upon the revenues of the bishop, and forced him to fly from his dominions. Enraged at this impious conduct, the pope excommunicated the king, and laid his kingdom under an interdict. The natural consequence was, that all things were thrown into confusion, and consternation and perplexity universally prevailed; so that Alphonso was obliged to consult measures to quell the rising discontent. It happened, however, that in the midst of these negotiations he was removed by death, and not only died under the papal malediction, but left his kingdom under the same curse. He was interred without royal honours in the conventual church.

Alphonso. church of Alcobaça. His person was above the common size ; he was brave and strong, but not devoid of many qualities worthy of blame. (*Mod. Univ. Hist.*)

ALPHONSO III. *Don*, king of Portugal, succeeded his brother Don Sancho II. in the year 1248. In the course of a war with the Moors, which he engaged in at the beginning of his reign, he considerably extended the Portuguese dominions. He took possession of the city of Fara, the capital of the Moorish kingdom, in the province of Algarve. Loula, another Moorish town, which was carried by storm, also fell into his hands. His power was thus extended abroad by the success of his arms, and the administration of his affairs at home became prosperous and popular by his wisdom and prudence. But the tranquillity and prosperity of the kingdom was somewhat disturbed by an interdict which it was put under by Pope Alexander IV. whose displeasure he had incurred by marrying Donna Beatrix, the natural daughter of Don Alonso the Wise, king of Castile, while his first wife was living. In 1262, when his first queen died, the interdict was removed by Pope Urban, a dispensation was granted, and the children of Donna Beatrix were legitimated. Hitherto frequent disputes had occurred between the kings of Portugal and Castile relating to the boundaries of the two kingdoms. To terminate all differences on this subject, and to prevent them in future, commissioners were appointed to define and settle the limits of their respective dominions ; and these were agreed to and acknowledged by a solemn deed.

Encouraged by the prosperity of his kingdom, and by the success which had attended his enterprises, Alphonso made an attempt to extend the influence of the crown, by obliging the clergy to contribute to the welfare of the state. But this measure, as might have been expected, was not quietly submitted to. It occasioned the revival of old disputes, the pope interfered, and in 1268 the kingdom was again laid under an interdict. He succeeded, by the wisdom of his negotiations, in obtaining from Castile an exemption of all claims upon the crown of Portugal, and in procuring an acknowledgement that its monarchs were entirely relieved from the performance of every kind of homage. He died in the year 1279, in the 69th year of his age, and in the 31st of his reign. Before his death, he was reconciled to the pope and clergy, having made a full and ample submission. This prince was tall in stature, of a prepossessing aspect, and of engaging manners. Alike removed from a disposition to extravagant expence or sordid avarice, in times of peace and prosperity he could indulge in magnificence ; but when his affairs required it, he failed not to regulate them by frugality and economy. To the poor he was a sincere friend. In a time of scarcity he pawned his crown to provide them with bread. His steady and vigorous administration secured to him the respect of the nobles and the obedience of the clergy. (*Mod. Univ. Hist.*)

ALPHONSO IV. king of Portugal, surnamed the *Brave*, was the son of King Denis. Instigated, it is said, by the queen dowager of Castile, and moved with jealousy against his natural brother Alphonso Sanchez, he revolted against his father, and commenced a civil war. In this unnatural and base war, he was justly unsuccessful ; but although he was reduced to subjection, yet his haughty and ungovernable

temper broke out in many occurrences, until he succeeded his father in 1324. Hunting was his favourite amusement at the time when he ascended the throne ; and one day entertaining his counsellors with a narrative of his sporting adventures during a month, one of them ventured to remonstrate against his conduct, and even proceeded to threaten, that if the grievances of his subjects were not speedily redressed, they would be forced to look out for a better king. Alphonso was greatly enraged ; but suddenly recollecting himself, he said " I perceive the truth of your remark ; he cannot long have subjects who will not be a king. Remember that from this day you have nothing to do with Alphonso the sportsman, but with Alphonso the king of Portugal." To this resolution he strictly adhered, and exercising the power of a despot, he overawed his subjects, without conciliating their favour or procuring their esteem. He displayed a conduct very singular in a young man, regarding those who had so vigorously opposed him when at war with his father, as friends to the crown, although enemies to the young ambitious prince. He commenced his reign with devising plans for the security of his family in the government, and the good of the kingdom ; he likewise manifested a strong benevolence of heart, in his affection for his consort Queen Beatrix, and his dutiful conduct towards his mother. Notwithstanding all those amiable qualities, he persecuted his brother Alonzo Sanchez, and wished to inflict the punishment due to him as a proscribed traitor ; which drove the desperate Alonzo to open rebellion. But, however, the natural good qualities of the heart of the king rose superior ; so that his persecuted brother was again received into favour. Not long after he engaged in war with Alonzo XI. king of Castile, and which, after several severe struggles with various success on both sides, terminated in an alliance, and in effectual assistance against the Moors. The artful and cruel part which he acted towards Donna Agnes de Castro, the mistress and concealed wife of his son, reflected the greatest disgrace upon his character. It is proper, however, to remark, that he was instigated to the murder of this princess by his courtiers. It was not therefore to be wondered at if his son was induced by this act to rise up in open rebellion against him, but the arms of his father were too formidable ; and after his submission, his father treated him with particular marks of attention. Instructed by the growing infirmities of years, he saw the termination of his reign and his life approaching. He began to compensate for his past errors and faults, by establishing acts of piety and benevolence, by redressing grievances, by restraining immorality through the establishment of pious laws, by dictating salutary maxims for the government of the state, by removing those from the seats of power, who were the most likely to become the objects of resentment after his death : he thus laboured to efface from the remembrance of his son the insult which he had received. While concerting these conciliatory measures, he died in May 1357, in the 32d year of his reign, and the 67th of his age, " with the character of an undutiful son, an unnatural brother, and a cruel father." But in many respects he deserves the character of a great man and a great king, brave and fortunate in war, but artful and indirect in his political measures, attached to his subjects,

Alphonso.

Alphonso. subjects, strict in the administration of justice, attentive to the public welfare, and assiduous in encouraging industry, and enriching his people." But after all, it must be acknowledged, that though he was feared, and even esteemed, he was not much honoured nor beloved, but was rather revered for a proper use of power, than relied upon as a public parent. His character is perhaps expressed in his device, which was an eagle on the wing, with the following motto, *Altiora peto*, "I aim at higher things."

ALPHONSO V. *Don*, king of Portugal, was born in 1432, and, on account of his heroic deeds, obtained the surname of the *African*. At the age of six years he succeeded his father King Edward. The administration of the affairs of the kingdom during his minority, was entrusted to his uncle Don Pedro, who although his public conduct met with general approbation, was persecuted as a traitor at the expiration of his regency, and with several persons who were attached to his interest, and involved in his misfortunes, was put to death. The young king had married the daughter of the regent; but even his influence, which was overpowered by the regent's enemies, could not save him from persecution. Afterwards indeed he did justice to his memory, and discovered an unusual mark of respect and attachment to his queen, by abstaining from all connection with the sex after her death, which happened in 1455, and it has been supposed, was occasioned by poison, administered by the enemies of her father.

Alphonso aspired to the acquisition of military glory. In the year 1458, he made great preparations to attack the Moors in Barbary. He assembled an army of 20,000 men, and equipped a fleet of 200 sail. He first directed his arms against Alcázar, which soon fell into his hands; and to maintain the footing which he had gained, he furnished this place with a strong garrison. For 12 years he prosecuted the war in Barbary with various success, in that time reduced Arzila and Tangier, and in 1740 returned to Portugal loaded with honours. It was then he obtained the surname of *African*, and to the titles which he derived from his ancestors, added that of *lord of the coasts of both seas*. And with a view to perpetuate the memory of these exploits and conquests, he caused a representation of them to be wrought in tapestry, a monument surely constructed of very frail materials, but not less durable than many which have been erected by ambition and vanity. During the war in Africa, a military order denominated *the knights of the sword* was founded.

Alphonso was less successful in supporting the claim of his niece Donna Joanna to the crown of Castile against Ferdinand and Isabella. Finding his own resources unequal to the contest in which he was engaged, he took a journey to France to solicit the aid of Lewis XI. But his solicitations proved fruitless; and the mortification which he experienced from this faithless monarch, filled him with melancholy, and induced him to resign his crown for the purpose of making a pilgrimage to the Holy Land. The administration of affairs during his absence, was committed to the hands of his son Don Juan, who governed the kingdom with great ability. When the king returned, he was joyfully received by the prince, and reinstated in

his authority. But the mind of Alphonso had lost its wonted vigour, and was unfit to resume the arduous duties of government. Oppressed still with a deep melancholy, he determined at length to withdraw from the cares of a kingdom, and to end his days in the repose and quiet of a monastery. But on his journey to the place of his retirement, he was seized with the plague at Cintra, where he died in the year 1481, in the 43d year of his reign, and the 49th of his age. The moderation, the prudence and wisdom, which this prince exhibited in his public conduct, were not more powerful in conciliating the love and veneration of his subjects, and of all good men, than were the amiable virtues of his private character. He was distinguished for his affability and condescension, his benignity and bounty, and especially for his unbounded charity. In the exercise of this latter virtue, he was honoured with the title of *redeemer of the captives*, in consequence of his having procured the freedom of many prisoners, whose ransom he cheerfully paid. Nor was he less eminent for his chastity and temperance, his attachment to letters, and his love and encouragement of learning. The first library in the palace of the kings of Portugal was founded in his time. He established and vindicated against the pretensions and hostile attempts of the Spaniards, a very profitable trade on the coast of Guinea, which country, was discovered during his reign, under the auspices of his uncle Don Henry, a celebrated character of that age. (*Mod. Univ. Hist.*)

ALPHONSO VI. *Don Enriquez*, king of Portugal, ascended the throne when only a child of thirteen years of age. It is not easy to conceive a kingdom in a more perilous situation than this at the death of Don John. The young king was remarkable for weakness of body, and imbecility of mind; the regency in the hands of a woman, and that woman a Castilian; the nation involved in war, and this respecting the title to the crown; many of the nobility engaged in feuds and contentions with each other, and some of them secretly disaffected to the reigning family; so that the queen scarcely knew to whom she could trust, or by whom she was to be obeyed. A very indecent joy was manifested by the people on the king's death, as if his death was the dissolution of government: but the great abilities of the queen, and the vigorous measures which she adopted, soon changed the face of affairs. For her own safety, and the prosperity of the kingdom, she appointed Don Francisco de Faro, count of Odemira, of the house of Braganza, governor to the king, and one of her principal ministers of state; and she made choice of Don Antonio de Meneses, count de Castenheda, to be his coadjutor. The former was a person in high repute among the nobility, in great favour with the people, entirely devoted to the interests of the queen, possessed of a large estate, and far advanced in years; the latter was also an aged man of great talents, and equally capable to preside in the cabinet, and to command in the field. As might naturally be expected, these men sometimes differed in opinion; but this difference never hurt the cause of the queen. Seconded, protected, and counselled by such able men, the nation began to feel the effects of the queen's firmness and superior talents.

The first important exertion of the queen was, to

Alphonso. send express orders to the count de San Lorenzo, who commanded on the frontiers, to act offensively; but the measure, though prudent in itself, was not attended with the desired success. About this time, however, the duke de St Germain, an Italian officer in the service of Spain, entered Portugal, besieged and took Olivenza and the castle of Moran. In consequence of this, the general was dismissed, and his place was filled by Juan Mendez Vasconcelles, a man in great favour with the troops, and universally popular. He engaged to act also upon the offensive, but being unsuccessful, he was only saved from punishment, by his simple and candid defence; in which he says, "that he had undertaken the siege in obedience to the order of the queen, and for the honour of the nation; and that he had raised it without orders, for the preservation of the army; that he knew the hazard he run when he did it, but that it gave him pleasure to think, that at the hazard, or even the loss, of his reputation and life, the troops of Portugal had been saved." He was declared innocent and worthy of the queen's favour, by the council of war who presided. Don Sancho Manuel, who commanded in Elvas, and defended it with equal bravery and conduct, showed himself to be an officer of a considerable degree of judgment, by his hazarding nothing more when he had performed his service, upon which the very being of the state depended; but it was the count de Castanheda who raised that siege, and forced the army of Spain in their lines. After some other political measures, some of them more and some of them less important; the queen regent finished in a manner, her administration, with the marriage of her only daughter, the princess Catharine, once intended for Lewis XIV. with Charles II. king of Great Britain, one of the most fortunate events that ever happened for Portugal; since it immediately procured them the protection of the English fleets, reinforcements of some thousands of horse and foot; besides adding much reputation to their affairs throughout Europe; which was the reason that the Spanish court opposed it with so much heat, or rather passion. By the vigorous exertions and fortunate victories of Montesclaros, the war was soon terminated to the honour of Portugal. The sixth and last victory in the course of 28 years, was obtained by the marquis de Marialva, which was chiefly owing to unforeseen accidents, and the determined courage of foreign troops, and to the great abilities of Schomberg. This victory determined the fate of the kingdom, though not of the sovereign; and it was easy to be seen by the more intelligent sort of people in Portugal, that the king would sooner or later be deposed.

Alphonso being struck with the palsy while a child, rendered it necessary to treat him with indulgence, on account of his weak state of health; consequently, as he rose to maturity, his want of parts, and the defects in his education, were very perceptible. It is alleged that a greater affection was shown by the queen his mother, to the infant Don Pedro, and that she endeavoured, at the time of their father's decease, to insinuate into the nobles an idea of preferring him; but they universally declined to make a breach in the succession, declaring it was difficult to make an estimate of the powers of a king who was then only a child. The queen yielded, and endeavoured by every pro-

per means to make him worthy of a crown, which, by birth, he was entitled to wear. The count de Odeira, who was charged with his education, found it a very difficult task to manage the young prince, who forgetful of his birth and destination, was prone only to those amusements which the youth of his age were accustomed to. His guardian and preceptor struggled with this disposition, and even ventured to take some pretty severe measures; but to his great mortification, it proved entirely abortive. Education can only improve, but can never confer mental abilities. Yet he was quick enough to perceive he was a king, which proved very fatal to him. Those who approached his person complied with his follies, and even commended the most absurd actions; and those who were independent of the court inveighed against him in the strongest terms, and, because guilty of some childish actions, they ascribed to him all the cruel and foolish accidents which happened in Lisbon. Unfortunately, however, for his adversaries, many of these actions, such as fighting of dogs, scouring the streets, encountering three men alone, running at a bull, and such like, indicate no want of strength or courage. A variety of facts that might be mentioned, are sufficient evidence that his natural dispositions were weak, wild, refractory, and unteachable; and that although he was born to reign, yet he was destitute of the qualities absolutely necessary in a prince. The direful consequences of this having been for some time experienced by the nation, the nobles at last were driven to the resolution of deposing the king, and exalting Don Pedro to the regency. In the morning of the next day after the determination, the marquis de Cascaes, at the head of the council, went to the palace to propose the resignation to the king. The king was in bed and fast asleep: the marquis ordered him to be awakened, and knocked violently at the door for that purpose; and when he had obtained admission, he is said to have upbraided him in very coarse terms for his laziness and inattention to public affairs at so critical a conjuncture; adding, that since he must be sensible of his want of abilities to govern a kingdom, the wisest method he could adopt was, to resign it in favour of his brother. The king absolutely refused to consent: but not long after, Don Pedro coming to the palace, ordered him to be confined in his apartment, where one of his favourites persuaded him, in the hope of being set at liberty, to make a short renunciation of the crown in favour of his brother Don Pedro, and his lawful issue, reserving the house of Braganza and its dependencies, together with 100,000 crowns out of the revenue of the crown. Nor was this deemed sufficient: for a paper was presented to him, making him avow, that for want of consummation, his marriage was null. This he at first declined; but, by the advice of some divines, he was prevailed on to subscribe the deed. When evening drew on, the unhappy king then perceived he was a prisoner; upon which he sent to request his brother to let him have John, who managed his dog-kennel, to keep him company. When Don Pedro heard it, losing his usual calmness, he burst into a violent fit of passion, and instantly gave orders, that those who were the most agreeable to him, should remain in his apartment. Such was the situation of affairs until the meeting of the states. But
in

Alphonso. in the mean time, the unfortunate Don Alphonso died, after he had been a prisoner near fifteen years, suddenly in the castle of Cintra, on the 12th of September, when he had borne the title of king almost twenty-seven, and had lived about forty years. It is reported, that he said in his last agonies, "I am now going; but it will not be long before the queen shall follow me, to give an account at the most awful tribunal, of the wrongs she has done me." (*Mod. Univ. Hist.*)

ALPHONSO III. the Great, king of Asturias, was born in 847, and succeeded his father Ordogno in 865. In consequence of the rebellion of Don Froila, not long after his accession to the throne, he was forced to leave his kingdom; but that usurper being assassinated, with universal applause he returned to his throne. In many successful enterprises against the Moors, in which he greatly enlarged his territories, he soon displayed the talents of a warlike and able prince. He formed a powerful alliance against the Moors, by marrying Ximene or Chimene, descended from the house of Navarre, which paved the way for a long series of victories. The great attention which he paid to the comfort and welfare of the common people, greatly disgusted his haughty nobles; which excited them to revolt against him in the advanced part of his life. Enjoying a small interval of tranquillity from the distraction and tumults of war, he called a general council of the clergy and nobility, enacted some useful regulations, and directed their attention to several other subjects, which contributed to the honour and happiness of his kingdom. Whilst he was busily occupied in repairing some of those towns which he had taken from the Moors, he was suddenly interrupted by them, and was under the necessity of defending himself with a considerable army, which he did with such success, that they were defeated with great loss. The unnatural rebellion of his son Don Garcias, at this time, greatly disturbed his government; but by the diligence of the father, this unnatural rebellion was soon quelled. The confinement of Garcias, and the new imposition of taxes, produced general murmurs among the people; which induced Alphonso, now worn out with years and incessant contentions, to assemble the states, and resign the reins of government into the hands of his son Don Garcias. He gave to his other son Don Ordogno the province of Galicia. The ambitious and military spirit which Don Garcias discovered in his father's reign, soon displayed itself in an attack on the Moors. By the advice of his father, to which he prudently listened, he was taught that these new conquests tended more to enrich the soldiers, than to the advantage of the crown. Alphonso, although far advanced in years, took upon himself the command of the army raised for new operations, and returned to Zamora loaded with spoils, and with increased reputation and fame, in the year 912. He died December 20. 912, two years after his abdication, 46 years from the time of his being associated with his father in the government, and when he was about 64 or 65 years of age. His great learning, and the patronage he gave to literature, his distinguished piety and virtue, and other princely qualities, raised this king high in the estimation of mankind. Some writers affirm that he composed a chronicle of the Spanish affairs, from the death of Recesuintho, to that of his own father Don Ordog-

no, which has been incorrectly published by Sandovel, and the later editions have sustained considerable injury. The bishop of Orensa, at whose request it was originally composed, published it in his own name to the world. (*Gen. Biog.*)

ALPHONSO X. the Wise, king of Leon and Castile, succeeded his father Ferdinand in the year 1252. He obtained the appellation of wise, not for his political knowledge as a king, but his erudition as a philosopher. In consequence of the general opinion of his princely qualities, and his uncommon generosity, he ascended the throne with universal approbation. The ill-concerted projects of his ambition, however, disturbed the prosperity of his reign. Pretending a better right than Henry III. of England to that territory, he directed his first attempt against Gascony. The arms of England, however, proved too formidable; and he was compelled to renounce his claim, on condition that Henry's son, afterwards King Edward I. should marry his sister Eleonora. At an expence which drained his treasures, and obliged him to debase his coin, he prepared for an expedition against the Moors in Barbary: but his maternal right to the duchy of Swabia, which he was called to defend, diverted him from it. Thus he formed a connexion with the German princes; and became a competitor, with Richard earl of Cornwall, for the imperial crown, in quest of which they both expended immense sums of money. The claims of several of the princes of the blood, gave exercise to his military talents; and he was successful both in opposing and defeating them. He formed the romantic design of visiting Italy in the year 1268; but the states firmly remonstrating, he was obliged to relinquish it. But, although he abandoned the design, yet it produced such discontents both among the common people and conspiracy among the nobles, that it required considerable exertion before the king could allay the ferment. Alphonso, still anxious of ascending the imperial throne, attempted it after the death of Richard earl of Cornwall, and even after Rodolph of Hapsburg was actually elected emperor of Germany, and for that purpose took a journey to Beaucaire to obtain an interview with the pope, in order to prevent him from confirming the election. The Moors, ever ready to draw the sword against him, took this opportunity of entering his dominions for the purpose of ravaging them. This ambitious journey, undertaken at so vast an expence, and productive of so much confusion in his kingdom, proved unsuccessful; for the pope would not realize his claim, or alter the former election. But his excessive ambition was soon punished by domestic calamity; for his eldest son died in this interval, and his second son Don Sanchez, having obtained great reputation in opposing the infidels, to the prejudice of his brother's children, laid claim to the crown. This claim was admitted by the states of the kingdom; but Philip king of France, supporting the cause of the children, whose mother was his sister Blanche of France, involved Alphonso in a war; and it occasioned the retreat of his own queen Yolande or Violante to the court of her father, the king of Arragon. While thus harassed with dissensions, he proclaimed war against France, and by the authority of the pope he renewed the war with the Moors, which proved so unfortunate, that he reluctantly concluded a truce with them, and engaged in a contest

Alphonso. with the king of Granada. These various measures exhausted his treasure; taxes were multiplied, and the affairs of the kingdom were in such confusion, that he was under the disagreeable necessity of calling an assembly of the states, which was held at Seville in the year 1281, where, on the king's proposal, the states consented to give a currency to copper money. In consequence of the intrigues of Don Sanchez his son, another assembly of the states was held at Valladolid, A. D. 1282, which deprived Alphonso of the regal dignity, and appointed Sanchez regent. Reduced to almost insurmountable difficulties, Alphonso solemnly cursed and disinherited his son, and by his last will, in the year 1283, confirmed the act of exclusion, and appointed, for the succession, the infants de la Cerda, and upon the failure of their heirs the kings of France; and at the same time supplicated the assistance of the king of Morocco against the power of his son. At the commencement of the next year, when Alphonso received information from Salamanca, that Sanchez was dangerously ill, his heart relented. He pardoned his son, revoked his curses, and then died, on the 4th of April 1284 in the 81st year of his age. His remains were interred in the cathedral of Seville; and he left behind him the character of a learned man, but a weak king. Alphonso has been charged with irreligion and impiety, chiefly on account of a well-known saying of his, viz. "if he had been of God's privy-council when he created the world, he could have advised him better." The various contradictory accounts, given by different writers, render the truth of this doubtful; but if ever such a horrible saying dropt from his lips, it must unquestionably be declared inconsistent with the character of an enlightened philosopher, and that reverence of the Creator which an enlarged contemplations of his works naturally inspires.

"An indevout astronomer is mad."

YOUNG.

He was an eminent proficient in science, and a patron of literature. He concluded that book of laws, known by the title of *Las Partides*, which his father had begun; and in that work displayed the abilities of a politician as well as those of a legislator. By obliging his subjects to use their own language, he redressed the confusion in law proceedings occasioned by intermixing Latin with the vulgar tongue. Under his patronage a general history of Spain was composed, which he took great pains in polishing; he also corrected many errors in the statutes of the university of Salamanca. Astronomy being his favourite study, he chiefly directed his attention to the improvement of that science; so that, even during the life of his father, he assembled at Toledo, a number of the most celebrated astronomers of his time, Christians, Jews, and Arabians, from all parts of Europe, for the purpose of examining the astronomical tables of Ptolemy, and correcting their errors. The completion of these tables employed them about four years, and in 1252, the first year of Alphonso's reign, they were completed; and they were called *Alphonsine Tables* from the name of this prince, who encouraged the construction of them by his unbounded liberality. It is reported that 400,000 ducats were expended on them, or, according to others, 40,000. Some have ascribed the principal management of this work to the Jewish Rabbi Isaac

Aben-Said; others, pretending to derive information from the MSS. of Alphonso, refer it to Aben-Ragee and Alcabitus. The other astronomers who were employed on this occasion were Aben-Musa Mohammed, Joseph Ben-Ali, and Jacob Abuena, Arabians: if there were any Christians, their names are unknown. The 30th of May 1252, which was the day of his accession to the throne, was fixed as the epoch of these tables. A book, entitled "The Treasure," is also ascribed to him, containing treatises of rational philosophy, physics, and ethics. He is likewise said to have been well acquainted with astrology and chemistry; in which last science, he is said to have compiled two volumes in cipher, which are extant, and to be found still in his Catholic majesty's library. But this work must be more curious than useful, if we consider the state of this science at that period. (*Gen. Biog.*)

ALPHONSO V. king of Arragon and Naples, succeeded his father in the year 1416. As the father had formerly been honoured with the appellation of *Just*, so the son was honoured with that of *Magnanimous*. The conspiracy of some of his own nobles against his life, together with the insolence of Pope Benedict XIII. greatly disturbed the tranquillity of his reign. Fortunately this conspiracy was discovered just when it was about to be carried into execution; and instead of proceeding with rigour against the conspirators, he generously tore a paper containing their names without reading, and added, "that he would at least force them to acknowledge, that he had a greater regard for their lives than they had for his." After quelling a disturbance in Sardinia, he was just making preparations to advance to Sicily, when Joan of Naples offered, if he would assist her against the pope, the duke of Anjou, and the constable Sforza, who had formed a confederacy to depose her, to adopt him as her son and heir. He readily accepted the proposal, and with a powerful army soon raised the siege of Naples, and was immediately declared heir apparent of her kingdom, and duke of Calabria. But as the queen was unfaithful, and did not fulfil her engagements, Alphonso took possession of Naples, and expelled her from it; but when the duke of Anjou again entered her territories, and made himself master of great part of them, she was obliged to renew her solicitations to Alphonso; who, in the year 1434, involved himself in a quarrel with the duke of Milan and the republic of Genoa, by besieging Gaeta in a second attempt to conquer Naples. The Genoese fleet engaged Alphonso; and all his ships were dispersed or destroyed, and himself taken prisoner. But such was the address of this prince, that when carried to Milan a prisoner, he there ingratiated himself so much into the duke's favour, that he became his friend and ally, and soon rose to greater power than formerly.

He got possession of Naples in 1443; and in an assembly of the states held at Beneventum, and then transferred to Naples, his sovereignty was recognized, and his son, Don Ferdinand, declared successor to the throne, and in consequence of this elevation he was deemed the sole arbiter of peace and war through all Italy. Naples became the residence of Alphonso during the remainder of his life; but his declining years were much disquieted by political dissensions and intrigues. The natural attendant of jealous old age at last

Alphonso

Alphonso,
Alphonsus.

last seized him; and in consternation and dread, he was removed from one castle of Naples to another, until he breathed his last on the 22d of June 1468, bequeathing to his natural son Ferdinand the kingdom of Naples, and to his brother Don Juan, king of Navarre, the kingdoms of Arragon, Valencia, Majorca, Sardinia, Sicily, and the principality and dependencies of Catalonia. Alphonso was not only deemed the ablest statesman, and the most renowned military commander in that age, but also the greatest prince that ever occupied the throne of Arragon. He was a distinguished patron of learning, and opened an asylum for the Greek literati expelled from Constantinople. His device was an open book. He frequently uttered this expression, "That an unlettered prince was but a crowned ass." He was brave and liberal; and in all his negotiations he disdained the mean artifices of intrigue and dissimulation. It is reported that his perusal of Quintus Curtius cured him of a disorder with which he was attacked at Capua. Such was his familiar intercourse with his subjects, and his affection towards them, that he walked unarmed and unaccompanied in his capital; and was wont to say, "that a father has nothing to fear in the midst of his children." While he was besieging Gaeta, he dismissed the women and children that were turned out of the town without any injury, saying, "That he had rather lose any city in his dominions than lose the reputation of humanity." He leaped into a shallop for the relief of one of his galleys, which with its whole crew and soldiers was just about to perish, exclaiming, "I had rather share than witness their calamity." Such was his generosity, that upon hearing an officer, who saw his treasurer bringing him 10,000 ducate, exclaiming, "I should only wish that sum to make me happy." "You shall be so," said Alphonso, and gave him the money in a present. He deemed dancing a certain degree of madness; but was strongly addicted to women, which involved him in many dishonourable intrigues, and justly entailed upon him the disgrace of an unfaithful husband to a kind and affectionate queen. (*Mod. Univ. Hist.*)

ALPHONSUS TOSTATUS, bishop of Avila, a learned and voluminous Spanish writer. He flourished about the middle of the 15th century, and by his uncommon abilities rose to the highest offices both in the civil and ecclesiastical departments of the state. At the age of 22 years he finished his studies at the university of Salamanca, having made great progress in every branch of learning then in estimation. He was present at the council of Basil, and was afterwards promoted to the bishopric of Avila. He died at the age of 40 years, in 1454, and was buried in the church of Avila. The following epitaph, expressive of his great erudition, was inscribed on his tomb.

Hic stupor est mundi qui scibile discutit omne.

"This is the wonder of the world who treated of every thing that could be known."

The numerous productions of Alphonsus are sufficient proofs of his laborious industry: during his life he wrote no less than 27 volumes in folio, of which 24 are commentaries on the Scriptures; the rest are on theological subjects. By the order of Cardinal Ximenes they were printed at Venice in 1530, and in 1596;

and at Cologne in 1612. Several of his pieces on ecclesiastical history, science, and literature in general, were separately printed at Salamanca in 1506, and also his commentary upon the Chronicon of Eusebius. Although high encomiums have been bestowed upon his works, they have nevertheless in the current of time and human improvement fallen into oblivion, (*Dupin.*)

ALPINI, PROSPERO, in Latin, *Prosper Alpinus*, a celebrated physician and botanist, was born at Marostica in the republic of Venice in November 1553. In his early years his inclination led him to the profession of arms, and he served some time in the Milanese. By the encouragement and persuasion of his father, who was a physician, he retired from the army, and devoted his attention to literature. To prosecute his studies with more advantage, he went to the university of Padua, where he was soon after elected deputy to the rector and syndic to the students. But in the discharge of his official duties, which was distinguished by prudence and address, he was not prevented from pursuing the study of physic which he had chosen. He continued his medical studies with zeal and success; and after having acquired the necessary qualifications, he was admitted to the degree of doctor of medicine in 1578. Soon after he left the university, and settled as a physician in consequence of an invitation from the citizens in Campo San Pietro, a small town in the Paduan territory.

In the course of his studies he had paid particular attention to plants, and had become an enthusiast in botanical science. The sphere of his present practice was too limited to afford him much opportunity of prosecuting his favourite study. He wished particularly to extend his knowledge of exotic plants; and the only means to attain this, he thought, was to study their economy and habits in their native soil. And to gratify this laudable curiosity an opportunity soon presented itself. George Emo, the consul for the Venetian republic in Egypt, appointed Alpini his physician. They sailed from Venice in September 1580; and after having experienced a tedious and dangerous voyage, arrived at Grand Cairo in the beginning of July the following year. Alpini spent three years in Egypt, and, by his industry and assiduity, greatly improved his botanical knowledge. With this view he travelled along the banks of the Nile, visited every place, and consulted every person from whom he expected any new information. From a practice in the management of date trees, which he observed in this country, Alpini seems to have deduced the doctrine of the sexual difference of plants, which was adopted as the foundation of the celebrated system of Linnæus. He says, "That the female date trees, or palms, do not bear fruit, unless the branches of the male and female plants are mixed together; or, as is generally done, unless the dust found in the male sheath, or male flowers, is sprinkled over the female flowers."

When Alpini returned to Venice in 1586 he was appointed physician to Andrea Doria prince of Melfi, and during his residence at Genoa, acquired so great a name as to be esteemed the first physician of his age. The Venetians became jealous that the Genoese state should number among its citizens a person of such distinguished merit and reputation, whose services might

Alphonsus,
Alpini.

Alpini
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Alps.

be essentially beneficial, and whose fame might be highly honourable, to his native country. In the year 1593, he was recalled to fill the botanical chair in the university of Padua, with a salary of 200 florins, which was afterwards augmented to 750. He discharged the duties of his professorship for many years with great reputation, till his declining health interrupted his labours. He died in the year 1617, in the 64th year of his age, and was succeeded as botanical professor by one of his sons. Alpini wrote the following works in Latin: 1. *De Medicina Ægyptiorum, libri iv.* "Of the Physic of the Egyptians, in four books;" printed at Venice, 1592, in 4to. 2. *De Plantis Ægypti liber:* "A treatise concerning the plants of Egypt;" printed at Venice, 1592, in 4to. 3. *De Balsamo Dialogus:* "A dialogue concerning the Balm of Gilead;" printed at Venice, 1592, in 4to. 4. *De Præsagienda vita et morte ægrotantium libri vii:* "Seven books concerning the method of forming a judgment of the life or death of patients;" printed at Venice, 1691, in 4to. 5. *De Medicina methodica, libri xiii:* "Thirteen books concerning Methodical Physic;" Padua, 1611, folio; Leyden, 1719, in 4to. 6. *De Rhapsontico Disputatio:* "A disputation held in the school at Padua concerning the Rhapsonticum;" Padua, 1612, and 1629, in 4to. 7. *De Plantis Exoticis, libri ii:* "Of exotic plants, in two books;" Venice, 1699, in 4to. He left several other works, which have never been printed; particularly, 8. The fifth book concerning the physic of the Egyptians. 9. Five books concerning the natural history of things observed in Egypt, adorned with figures of plants, stones, and animals. (*Bog. Dict.*)

ALPINIA. See BOTANY Index.

ALPINUS. See ALPINI.

ALPISTE, or ALPIA, a sort of seed used to feed birds with, especially when they are to be nourished for breeding. The alpiste seed is of an oval figure, of a pale yellow, inclining to an isabel colour, bright and glossy. It is an article of the corn-chandlers and seedsmen's trade.

ALPS, in *Ancient Geography*, a range of high mountains, separating Italy from Gaul and Germany, in the form of a crescent. They take their rise from the Vada Sabatia, or Savona; and reach to the Sinus Flanaticus (now Golfo di Carnaro of the Adriatic), and the springs of the river Colapis (now the Kulpe); extending, according to Livy, 2000 stadia in length, but in reality about 550 miles: they are divided into several parts, which have different names. From Savona to the springs of the Varus, where the Alps lie against the sea of Genoa, they are called *Maritime*, now *le Montagne di Tenda*. These extend from south to north, between Gaul to the west, and Genoa to the east, beginning at Monaco on the Mediterranean; then running out through the east of the county of Nice, and between that and the marquisate of Saluzzo, terminate at length at Mount Viso, between Dauphiné and Piedmont. Hence to Susa run the *Alpes Cotticæ* (Sueton.) *Cottanæ* (Tacitus); mountains extremely high, separating Dauphiné from Piedmont, and extending from Mount Viso to Mount Cenis, between the *Alpes Maritimæ* to the south, and the *Graie* to the north. The *Alpes Graie* (Pliny), so called from the passage of Hercules, begin from Mount Cenis, where the *Cotticæ* terminate; and run out between Savoy and the Tarentese to the

west, and Piedmont and the duché d'Aouste to the east, quite to the Great St Bernard, where the *Alpes Penninæ* begin. They are also called by some *Graie Alpes*, and *Grains Mons* (Tacitus); which extend from west to east, between St Bernard and the Adula, or St Gothard; and thus they run out between the Valaise to the north, and the Milanese to the south. With these are continued the *Alpes Rheticæ*, to the head of the river Piave; a part of which are the *Alpes Tridentinæ*, to the north of Trent. To these join the *Alpes Noricæ*, reaching to Doblach in Tyrol, to the north of the river Tajamento: thence begin the *Alpes Carnicæ*, or of *Carniola*, extending to the springs of the Save: and the last, called *Alpes Pannonicæ*, and *Julicæ*, extend to the springs of the Kulpe. Some, however, extend the Alps to the north of Dalmatia; others, again, to Thrace and the Euxine. But their termination at the Kulpe, as above, is more generally received. They were formerly called *Albiæ*, and *Alpionia* (Strabo.) Through these mountains Hannibal forced his passage into Italy, by pouring vinegar on the rocks, heated by burning large piles of wood on them, by which means they became crumbled, (Livy). They are covered with perpetual snow.

The Alps are the highest mountains in Europe. Their highest summit, Mont Blanc, rises to the height of 15,680 feet above the sea. They begin at the Mediterranean; and stretching northward, separate Piedmont and Savoy from the adjacent countries; whence directing their course to the east, they form the boundary between Switzerland and Italy, and terminate near the extremity of the Adriatic sea, north-east of Venice. It was over the western part of those mountains, towards Piedmont, that Hannibal forced his passage into Italy.

The prospect from many parts of this enormous range of mountains is extremely romantic, especially towards the north-west. One of the most celebrated is the Grande Chartreuse, where is a monastery founded by St Bruno about the year 1084. From Échelles, a little village in the mountains of Savoy, to the top of the Chartreuse, the distance is six miles. Along this course, the road runs winding up, for the most part not six feet broad. On one hand is the rock, with woods of pine trees hanging over head; on the other a prodigious precipice almost perpendicular; at the bottom of which rolls a torrent, that, sometimes tumbling among the fragments of stone which have fallen from on high, and sometimes precipitating itself down vast descents with a noise like thunder, rendered yet more tremendous by the echo from the mountains on each side, concurs to form one of the most solemn, the most romantic, and most astonishing scenes in nature. To this description may be added the strange views made by the crags and cliffs, and the numerous cascades which throw themselves from the very summit down into the vale. On the top of the mountain is the convent of St Bruno, which is the superior of the whole order. The inhabitants consist of 100 fathers, with 300 servants, who grind their corn, press their wine, and perform every domestic office, even to the making of their clothes. In the Album of the fathers is an admired alcaic ode, written by the late ingenious Mr Gray when he visited the Chartreuse, and which has since been published among his works.

The glaciers of Savoy are also justly reckoned among the

Alps.

the most stupendous works of nature. These are immense masses of ice, lodged upon the gentler declivities amidst the Alps, and exhibiting representations beyond conception fantastic and picturesque. In the extraordinary narrative of M. Bourrit's journey hither, we meet with the following account of the Prieuré, in the valley of Chamouni. "We had (says he) the magnificent prospect of a chain of mountains, equally inaccessible, and covered with ice: and above the rest that of Mont Blanc, whose top seemed to reach, and even pierce, the highest region of the clouds. The chain upon which this mountain looks down like a giant, is composed of masses of rock which terminate in spikes or spires, called the *Needles*, and which are ranged like tents in a camp. Their sides appear lighter and more airy, from the ornament of several hollow breaks and furrows fretted in the rock itself, as well as from the different streaks and panes of ice and snow, which, without changing the general character of their form, or the majesty of their appearance, give them a picturesque variety. Lower down, the eye surveys with ravishment, the hills of ice, and the several glaciers, extending almost into the plain, whilst this appears like an artificial garden, embellished with the mixture of a variety of colours. We have a picturesque opposition to this chain, which is formed by innumerable mountains at the distance of near 50 leagues, between whose tops we have a glimpse of those several plains which they environ."

M. de Saussure, who had visited those mountains about two months before M. Bourrit, felt himself naturally electrified in this place. This extraordinary phenomenon seems not to have been experienced by the latter or his company; but they heard a long continued rumbling noise like that of thunder, which was rendered more awful by the silence of the place where they stood. This noise proceeded from the subsequent causes, viz. the avalanches of snow, which separated from the tops of the mountains, and rolled down to the bottom; considerable fragments of the rocks which followed them, overturning others in their fall; and massy blocks of ice, which precipitated from the summits.

The valley of Montanvert appears to be peculiarly romantic. "Here (says M. Bourrit) we beheld a spacious icy plain entirely level. Upon this there rose a mountain all of ice, with steps ascending to the top, which seemed the throne of some divinity. It likewise took the form of a grand cascade, whose figure was beyond conception beautiful; and the sun, which shone upon it, gave a sparkling brilliance to the whole. The valley on our right hand was ornamented with prodigious glaciers, that, shooting up to an immeasurable height between the mountains, blend their colours with the skies, which they appear to reach."

ALPS, besides its proper signification, by which it denotes a certain chain of mountains which separate Italy from France and Germany, is frequently used as an appellative to denote any mountains of extraordinary height or extensive range. In this sense, Ausonius and others call the Pyrenean mountains *Alps*; and Gellius the Spanish Alps, *Alpini Hispani*.

Hence also we say, the *British Alps*, the *Asiatic Alps*, the *Alps of America*.

The *Scottish Alps* terminate in a most sublime and

Alps.

abrupt manner at the great promontory, the *Alta Ripa* of Ptolemy, the *Ord* or *Aird*, i. e. the *Height of Caithness*. The upper part is covered with gloomy heath; the lower is a stupendous precipice, excavated into vast caverns, the haunt of seals and different sea fowl. On the eastern side of the kingdom, this is the striking termination of the vast mountains of Scotland which form its Highlands, the habitation of the original inhabitants, driven from their ancient seats by the ancestors of Lowland Scots, descendants of Saxons, French, and Normans; congenerous with the English, yet absurdly and invidiously distinguished from them. Language, as well as striking natural boundaries, mark their place. Their mountains face on the west the Atlantic ocean; wind along the west of Caithness; among which Morven and Scaraben, Ben Hop, and Ben Lugal, arise pre-eminent. Sutherland is entirely alpine, as are Ross-shire and Inverness-shire. Their *Summe Alps* are, Meal Fourvounich, the Coryarish, Benewich, and Benevish near Fort William; the last of which is reported to be 1450 yards in height. Great part of Aberdeenshire lies in this tract. It boasts of another Morven, soaring far beyond the others. This is the centre of the Grampian hills, and perhaps the highest from the sea of any in Great Britain. They again comprehend the eastern part of Perthshire, and finish on the magnificent shores of Lochlomond; on the western side of which Benlomond rises, distinguished among its fellows. From hence the rest of North Britain forms a chain of humbler hills; but in Cumberland, part of Westmorland, Yorkshire, Lancashire, and Derbyshire, the Alps resume their former majesty. A long and tame interval succeeds. The long sublime tract of Wales arises, the ancient possession of the ancient British race. From the Ord, the great mountains recede inland, and leave a vast flat between their bases and the sea, fronting the waves with a series of lofty rocky precipices, as far as the little creek of Staxigo: the whole a bold, but most inhospitable shore for shipping. Wick and Staxigo have indeed their creeks, or rather chasms, which open between the cliffs, and may accidentally prove a retreat, unless in an eastern gale.

The *Asiatic Alps* are described under the articles *ALTAIC Chain* and *WERTURIAN Mountains*.

The *American Alps* are, the *ANDES* or *Cordilleras*, in South America; and the *APALACHIAN* or *Alleghany* mountains in North America.

The highest ground in North America is placed by Captain Carver in lat. 47°, Long. W. from London 98°, between a lake from which the Oregon flows, and another called *White-Bear Lake*, from which arises the Mississippi.

This exalted situation is part of the Shining Mountains, which are branches of the vast chain which pervades the whole continent of America. It may be fairly taken from the southern extremity, where Staten Land and Terra del Fuego rise out of the sea as insulated links to an immense height, black, rocky, and marked with rugged spiry tops, frequently covered with snow. New Georgia may be added as another horribly congenial, rising detached farther to the east. The mountains about the straits of Magellan soar to an amazing height, and infinitely superior to those of the northern hemisphere under the same degree of latitude. From the north side of the straits of Magellan,

Alps. lan, they form a continued chain through the kingdoms of Chili and Peru, preserving a course not remote from the Pacific ocean. The summits, in many places, are the highest in the world. There are not less than 12, which are from 2400 toises high to above 3000. Pichincha, which impends over Quito, is about 35 leagues from the sea; and its summit is 2430 toises above the surface of the water. Cayambe, immediately under the equator, is above 3000; and Chimborazo higher than the last by 200. Most of them have been volcanic, and in different ages marked with eruptions far more horrible than have been known in other quarters of the globe. They extend from the equator through Chili; in which kingdom is a range of volcanoes, from lat. 26. south, to 45. 30. and possibly from thence into Terra del Fuego itself; which, forming the straits of Magellan, may have been rent from the continent by some great convulsion, occasioned by their labourings, and New Georgia forced up from the same cause. An unparalleled extent of plain appears on their eastern side. The river of Amazons runs along a level clothed with forests, after it bursts from its confinement at the Pongo of Borjas, till it reaches its sea-like discharge into the Atlantic ocean.

In the northern hemisphere, the Andes pass through the narrow isthmus of Darien into the kingdom of Mexico, and preserve a majestic height and their volcanic disposition. The mountain Popocatepec made a violent eruption during the expedition of Cortez, which is most beautifully described by his historian Antonio de Solis. This is probably the same with the volcano observed by the Abbé d'Auteroche, in his way from Vera Cruz to Mexico; which, from the nakedness of the lavas, he conjectured to have been but lately extinguished. From the kingdom of Mexico, this chain is continued northward, and to the east of California; then verges so greatly towards the west, as to leave a very inconsiderable space between it and the Pacific ocean; and frequently detached branches jut into the sea and form promontories; which, with parts of the chain itself, were often seen by our navigators in the course of their voyages. Some branches, as we have before observed, extend towards the east, but not to any great distance. A plain, rich in woods and savannahs, swarming with bisons or buffaloes, stags, and Virginian deer, with bears, and a great variety of game, occupies an amazing tract, from the great lakes of Canada, as low as the gulf of Mexico; and eastward to the other great chain of mountains, the Apalachian, which are the Alps of that side of northern America. Its commencement is supposed to be about Lake Champlain and Lake George, with branches pointing obliquely to the river St Lawrence eastward, and rising on its opposite coasts; others extending as far as Nova Scotia, but in their progress eastward diminish in height. The main chain passes through the province of New York, where it is distinguished by the name of the *Highlands*, and lies within 40 miles of the Atlantic. From thence it recedes from the sea, in proportion as it advances southward; and near its extremity in South Carolina is 300 miles distant from the water. It consists of several parallel ridges divided by most enchanting valleys, and generally clothed with variety of woods. These ridges rise gradually from the east, one above the other, to

the central; from which they gradually fall to the west, into the vast plains of the Mississippi. The middle ridge is of an enormous bulk and height. The whole extends in breadth about 70 miles; and in many places leaves great chasms for the discharge of the vast and numerous rivers which rise in the bosoms of the mountains, and empty themselves into the Atlantic ocean, after yielding a matchless navigation to the provinces they water.

Beyond the branch of the Apalachian mountains called *The Endless*, is another of amazing extent, nearly as high as the mountains themselves. This plain (called the *Upper Plain*) is exceedingly rich land; begins at the Mohocks river; reaches to within a small distance of Lake Ontario; and to the westward forms part of the extensive plains of the Ohio, and reaches to an unknown distance beyond the Mississippi. Vast rivers take their rise, and fall to every point of the compass; into Lake Ontario, into Hudson's river, and into the Delaware and Susquehanna. The tide of Hudson's river flows through its deep-worn bed far up, even to within a small distance of the head of the Delaware; which, after a furious course down a long descent, interrupted with rapids, meets the tide not very remote from its discharge into the ocean.

Lower Alps, Department of, in France. This department is one of four into which the former Provence is divided. It is bounded on the north by the department of the Upper Alps; on the east by Piedmont, and the department of the Maritime Alps; on the south by the department of the Var, and the north-east extremity of that of the Mouths of the Rhone; and on the west, by the departments of Vaucluse and the Drome: the chief town is Digne. Its superficies is about 1,459,699 square acres; population 147,910 individuals. It is divided into five communal districts.

Upper Alps, Department of. This department makes a part of Dauphiné, which contains three. It is bounded on the north by the departments of Mont Blanc and Isere; on the east by Piedmont; on the south by the department of the Lower Alps; on the west, by that of the Drome, and part of that of Isere. The soil consists of enormous mountains and narrow valleys. Two-thirds of the surface are useless for agricultural purposes. The north wind, which generally prevails, renders the climate cold, and the snow remains in some of the valleys eight months of the year. The principal river is the Durance, which is extremely rapid, and commits great ravages by its inundations. Embrun is the principal town. Its superficies is about 1,084,614 square acres; population 121,523 individuals. It is divided into three communal districts.

Maritime Alps, a department of France, formed of the county of Nice, but which was separated from that kingdom in 1814.

ALPÚXARRAS, or ALPAXARES, mountains of Spain, in the province of Granada, on the coast of the Mediterranean sea. They are about 17 leagues in length and 11 in breadth, reaching from the city of Velez to Almeria. They are inhabited by Moors, who are the remains of the dispersion and ruin of their empire. They embraced the Christian religion; but preserve their own manner of living and their language, though much corrupted. Here is a rivulet between Pitros

Alpuxarras Pitros and Portugos, which dyes linen that is dipped in it black in an instant. Near this rivulet is a cavern, from which proceeds so malignant a steam, that it destroys such animals as come near it. The Moriscos cultivate the soil extremely well, and plant fruit trees; some of which grow to a prodigious height and thickness, and give the mountains a very agreeable aspect.

ALQUIER, a liquid measure used in Portugal to measure oil, two of which make an almond. See **ALMOND**.

ALQUIFOU, or **ARQUIFOU**, is a sort of lead ore, which, when broken, looks like antimony. It is used by the potters to give a green varnish to their works, and thence is called *potters ore*. It is met with in Cornwall, &c. The potters mix a small portion of manganese with the alquifou, and then the varnish or glazing on their ware is of a blackish hue.

ALREDUS, **ALURED**, or **ALUREDUS**, of Beverley, one of the most ancient English historians, was born at Beverley in Yorkshire. He wrote in the reign of Henry I. There are no circumstances of his life known with any degree of certainty. It is generally believed that he was educated at Cambridge, and that he afterwards became one of the canons and treasurer of St John's at Beverley. And we learn in a note of Bishop Tanner's, that, for the sake of improvement, he travelled through France and Italy; and at Rome became domestic chaplain to Cardinal Othoboni. He died in the year 1128 or 1129, leaving behind him the following works: 1. *The Annals of Alured of Beverley*; which was published at Oxford in 1716, by Mr Hearne, from a manuscript which belonged to Thomas Rawlinson, Esq. It contains an abridgement of our history from Brutus to Henry I. written in Latin, and with great accuracy, elegance, and perspicuity. 2. *Libertates ecclesiæ S. Johannis de Beverlac*, &c. a manuscript in the Cottonian library. It is a collection of records relative to the church of Beverley, translated from the Saxon language. These are the only works which were written by Alredus. (*Biog. Dict.*)

ALRESFORD, a town of Hampshire, seated on the road from London to Southampton, close by the river Itching, which feeds a great pond to the left of the town. Part of a Roman highway runs from hence to Alton. It has one church, and two principal streets, which are large and broad; and has a small manufacture of linens. It is 57 miles distant from London, and contained 1429 inhabitants in 1811.

ALSA, in *Ancient Geography*, a river of Carniola (Pliny), now the *Ausa*, running by Aquileia, with a short course from north to south, into the Adriatic; where Constantine, the son of Constantine the Great, fighting against Constans his brother, lost his life.

ALSACE, formerly a province of France, bounded on the east by the Rhine, on the south by Switzerland, on the west by Lorraine, and on the north by the palatinate of the Rhine. It was formerly a part of Germany, but was given to France by the treaty of Munster. It is one of the most fruitful and plentiful provinces in Europe, abounding in corn, wine, wood, flax, tobacco, pulse, fruits, &c. The mountains which divide it from Lorraine are very high; and generally covered with fir, beech, oak, and hornbeam.

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Those on the side of Switzerland are less high; and furnished with all sorts of wood, as well for fuel as building. The country itself is diversified with rising hills and fertile vales, besides large forests; but that between the rivers Ill, Hart, and the Rhine, as far as Strasburg, is inferior to the rest, on account of the frequent overflowing of the Rhine. In High Alsace there are mines of silver, copper, and lead. They however work none but those of Giromany, from which are annually drawn 1600 marks of silver, each mark being eight ounces; and 24,000 pounds of copper: but the expence of working them is equal almost to the profit. There are iron works in several parts of Alsace, and particularly at Betford. There is a mineral spring at Sultsbach, near Munster, in High Alsace; which is in great reputation for the palsy, weakness of the nerves, and the gravel.—The original inhabitants of Alsace are honest and good-natured, but wedded to their own manners and customs. The fruitfulness of their country renders them indolent and inactive; for the Swiss make their hay and reap their corn, as well as manage the vintage of High Alsace, which sends a great deal of money out of the province. The common language is the German; but the better sort of people in the towns speak French; and, even in the country, they speak French well enough to be understood.

The number of inhabitants since the peace in 1814, has been computed at 915,191, who are mostly Lutherans and Roman Catholics. By the late division of France this province forms two departments, viz. those of the Upper and Lower Rhine; the capital of the former being Colmar, and that of the latter Strasburg; but formerly it was divided into Upper and Lower Alsace, the former contained 32 large and small towns, and the latter 39, and in both there are upwards of 1000 market towns and villages. The Rauraci, Sequani, and Mediomatrici, were the ancient inhabitants of this province. Under the Merovingian kings its name first occurs in the history of France, and it most probably is derived from the river Ell or Ill, the inhabitants on the borders of which were called *Elsasson*, from whom the country itself was afterwards denominated *Elsas*, in Latin *Elsatia*, *Alisatia*, and *Alsatia*. The Romans wrested it from the Celtæ; from them it passed into the hands of the Germans; and after the famous battle of Tolbiac, gained by Clovis in 496, it passed into the possession of the Franks. It was incorporated at a future period with the kingdom of Austrasia; and, in 1732, it was subjected, like the rest of the monarchy, to the laws of Pepin and his successors. Lotharius, the eldest son of Lewis Debonnaire, at the decease of his father in 840, obtained it, and united it to that part of the empire of the Franks which fell to him, and was generally known by the name of *Lotharingia*, or *Lorraine*. Afterwards it fell to his youngest son Lotharius by inheritance, and after him, in 869, it became a province of Germany, and was governed by dukes.

About a century before the title of duke was abolished, the provincial counts who governed under them in Alsace, assumed the title of *Landgraves*, and the countries over which they presided, obtained the name of *Landgravates*, the one superior and the other inferior. The best part of the inferior was conveyed to the bishops of Strasburg in 1375, who assumed the

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title of *Landgrave of Alsace*. In after times, the government was given by the emperors to several families, until at last Ferdinand I. bestowed it upon the German line of his own family, and consequently it remained in the house of Austria. The property of the town of Brisac, the landgrave of the Upper and Lower Alsace, Sundgau, and the districts of the ten united imperial cities in Alsace, with the whole sovereignty belonging to them, was for ever ceded by the emperor to the crown of France, at the peace of Munster in 1648. The perpetual sovereignty of the city of Strasbourg, together with all its dependencies on the left of the Rhine, were ceded to France by the peace of Ryswick in 1697.

ALSEN, an island of Denmark, situated in the Lesser Belt, or entrance into the Baltic sea, between Sleswick and Funen, 100 miles west of Copenhagen. It extends in length six leagues, and about two in breadth. The soil is fertile, producing abundance of fruit and variety of grain, with large crops of aniseeds, a carminative much used in seasoning the food and mixing with the bread all over the Danish dominions. E. Long. 9. 55. N. Lat. 55. 12.

ALSFIELD, a town of Germany, in the landgrave of Hesse Cassel, ten miles north-west of Marburg, containing 3020 inhabitants. It is an ancient town, and well built; and the inhabitants were the first of this country who embraced the Reformation. E. Long. 9. 5. N. Lat. 50. 40.

ALSHASH, a very beautiful city in Buckharia, supposed to be the same with that which is now called *Tashcant*, the capital of the eastern part of Turkestan, possessed by the Kassats. It is situated on the river *Sihun*, now *Sir*, and had a well watered garden for every house; but was ruined by Jenghiz Khan, who took the city, and caused a great number of its inhabitants to be massacred.

ALSHEDA, a parish in the province of Smaland, in Sweden, where a gold mine was discovered in 1738.

ALSINA, in *Botany*, a synonyme of the theligonum. See THELIGONUM, BOTANY Index.

ALSINASTRUM, in *Botany*, the trivial name of the elatine. See ELATINE, BOTANY Index.

ALSINE, or CHICKWEED. See BOTANY Index.

The common chickweed affords a remarkable instance of what is called the *sleep of plants*; for, every night, the leaves approach in pairs, so as to include within their upper surfaces the tender rudiments of the new shoots; and the uppermost pair but one at the end of the stalk are furnished with longer leaf stalks than the others; so that they can close upon the terminating pair, and protect the end of the branch.

ALSIRAT, in the Mahometan theology, denotes a bridge laid over the middle of hell, finer than a hair, and sharper than the edge of a sword, over which people are to pass, after their trial, on the day of judgement. To add to the difficulty of the passage, Mahomet assures, that the Alsirat, narrow as it is, is beset with briars and thorns; none of which, however, will be any impediment to the good, who shall fly over it like the wind, Mahomet and his Mussulmans leading the way; whereas the wicked, by the narrowness of the path, the entangling of the thorns, and extinction of the light which directed the former to paradise,

will soon miss their footing, and tumble headlong into hell, which is gaping beneath to receive them.

ALSIUM, in *Ancient Geography*, a city of ancient Etruria, occupying (according to Cluverius) the spot on which *Pala* now stands. We are told by Dionysius Halicarnassensis, that Alsium was built by the Aborigines, long before the Tyrrhenians invaded Italy. In this case it must have been founded not long after the dispersion in the days of Peleg. Its founder is said to have been one *Alæsus*, *Alesus*, or *Alisa*; whom some conjecture to have been Alisah, or Elisha, the son of Javan, mentioned in Scripture.

ALSOP, ANTHONY, an English divine and poet, was educated at Westminster school, and from thence elected to Christ-church, Oxford, where he took the degree of M. A. in March 1696, and of B. D. in December 1706. On his coming to the university, he was very soon distinguished by Dean Aldrich, and published *Fabularum Æsopicarum Delectus*, Oxon. 1698, 8vo, with a poetical dedication to Lord Viscount Scudamore, and a preface in which he took part against Dr Bentley in the famous dispute with Mr Boyle. He passed through the usual offices in his college to that of censor with considerable reputation; and for some years had the principal noblemen and gentlemen belonging to the society committed to his care. In this employment he continued till his merit recommended him to Sir Jonathan Trelawney, bishop of Winchester, who appointed him his chaplain, and soon after gave him a prebend in his own cathedral, together with the rectory of Brightwell in the county of Berks, which afforded him ample provision for a learned retirement, from which he could not be drawn by the repeated solicitations of those who thought him qualified for a more public character and a higher station. In 1717 an action was brought against him by Mrs Elizabeth Astrey of Oxford, for a breach of a marriage contract; and a verdict obtained against him for 2000l. which probably occasioned him to leave the kingdom for some time. His death, which happened June 10. 1726, was occasioned by his falling into a ditch that led to his garden door. A quarto volume was published in 1752, under the title of *Antonii Alsopi, Ædis Christiani Alumni, Odarum libri duo*. Four English poems of his are in Dodsley's Collection, one in Pearch's, several in the early volumes of the Gentleman's Magazine, and some in "The Student." Mr Alsop is respectfully mentioned by the facetious Dr King of the Commons (Vol. i. p. 236), as having enriched the commonwealth of learning, by "Translations of Fables from Greek, Hebrew, and Arabic;" and not less detractingly by Dr Bentley, under the name of "Tony Alsop, a late editor of the Æsopian Fables." (*Biog. Diet.*)

ALSOP, Vincent, an English nonconformist divine, was born in Northamptonshire, and educated at St John's college, Cambridge, where he took the degree of Master of Arts. When he received deacon's orders, he went to Rutlandshire, and settled at Oakham, where he was an assistant to the master of the free-school. As he was a man of a sprightly turn, he fell into indifferent company; but was reclaimed by the frequent admonitions of the Reverend Mr Benjamin King. He afterwards married that gentleman's daughter, and becoming a convert to his principles, received

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ed ordination in the Presbyterian way, not being satisfied with that which he had from the bishop. He was settled at Wilbee in the county of Northampton, whence he was ejected in 1662, for nonconformity. After this he ventured to preach sometimes at Oakham, and at Wellingborough where he lived, and was once six months in prison for praying by a sick person. A book he wrote against Dr Sherlock in a humorous style, made him well known to the world, and induced Mr Cawton, an eminent nonconformist in Westminster, to recommend him to his congregation for his successor. On receiving this call he quitted Northamptonshire, and came to London, where he preached constantly, and wrote several pieces which were extremely well received by the public. His living in the neighbourhood of the court exposed him to many inconveniences; but these ended with the reign of Charles II. or at least in the beginning of the next reign, when Mr Alstop's son engaging in treasonable practices was freely pardoned by King James. After this our divine went frequently to court, and is generally supposed to have been the person who drew the Presbyterians address to that prince for his general indulgence. After the Revolution, Mr Alstop gave public testimonies of his attachment to government; yet upon all occasions he spoke very respectfully of King James, and retained a very high sense of his clemency in sparing his only son. The remainder of his life he spent in the exercise of his ministry, preaching once every Lord's day; besides which he had a Thursday lecture, and was one of the lecturers at Pinners hall. He lived to a great age, and preserving his spirits to the last, died in May 1703. On grave subjects he wrote with a becoming seriousness: but where wit might properly be shown, he displayed it to great advantage. His funeral sermon was preached by Mr Slater, and his memory will be always preserved by his own learned and elegant writings. Of these the most remarkable, besides his sermons, are, 1. *Antiso-zo*; in vindication of some great truths opposed by Dr William Sherlock, 8vo, 1675. 2. *Melius Inquirendum*; in answer to Dr Goodman's *Compassionate Inquiry*, 8vo, 1679. 3. *The Mischief of Impositions*; in answer to Dr Stillingfleet's *Mischief of Separation*, 1680. 4. *A faithful Reproof to a False Report*, with reference to the Differences among the United Ministers in London, 8vo. (*Biog. Brit.*)

ALSTEDIUS, JOHN HENRY, a German Protestant divine, and one of the most indefatigable writers of the 17th century. He was some time professor of philosophy and divinity at Herborn in the county of Nassau: From thence he went into Transylvania, to be professor at Alba Julia; where he continued till his death, which happened in 1638, in the 50th year of his age. His *Encyclopædia* has been much esteemed even by the Roman Catholics; it was printed at Lyons, and sold very well throughout all France. His *The-saurus Chronologicus* is by some considered as one of his best works, and has gone through several editions. He also wrote *Triumphus Biblicus*, to show that the principles of all arts and sciences are to be found in the scriptures. He was a Millenarian; and published, in 1627, a treatise *De mille annis*, in which he asserted that the reign of the saints on earth was to begin in 1694.

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Alstonia.

ALSTON, CHARLES, M. D. a botanical and medical writer, was born in the west of Scotland in the year 1683. He began his studies at the university of Glasgow, and about this time he had the good fortune to be taken under the patronage of the duchess of Hamilton, which afforded him an opportunity of pursuing the bent of his inclination, by attaching himself to the study of physic. About the age of 33, along with his friend and companion the celebrated Alexander Munro, he went to Leyden, and studied three years under Boerhaave. On their return to their native country, they, in conjunction with Rutherford, Sinclair, and Plummer, undertook departments in the college of Edinburgh, and by their abilities and industry, laid the foundation of that school of physic. The branches of botany and materia medica were long the favourite studies of his life, consequently he undertook that department, and continued to lecture on them with increasing reputation until his death, which happened in November 1760, at the age of 77 years. His talents appear to have been naturally strong, which he improved and strengthened with great assiduity and industry, and employed them successfully in the service of science. In the year 1753, his dissertation on the sexes of plants, in which he combats the doctrine of Linnæus, was published in the first volume of the Edinburgh Physical and Literary Essays. The general plan of the work is conducted with much ingenuity, supported by some strong experiments, and although in the opinion of the learned, it has failed in its principal design, yet it must be acknowledged to be one of the best argued pieces on that side of the question. An asperity of language is sometimes used, very unsuitable to a scientific topic; but however, it is proper to remark, that Linnæus had given some reasons for this conduct by the nature of some of his descriptions. In the fifth volume of the Edinburgh Medical Essays, we have a short paper by Dr Alston on the efficacy of the powder of tin, to destroy or expel worms from the bowels. He informs us, that he received the prescription from an empiric, who was renowned for his skill in curing persons afflicted with that disease. The patient received the first morning one ounce of tin reduced to powder, and half an ounce each of the two following mornings, and was then purged with the infusion of senna and manna. He speaks with great certainty upon the efficacy of this medicine, which certainly has considerable power in these cases, and may be given to the most delicate subjects with perfect safety. Dr Alston also engaged in a chemical controversy respecting quicklime with Dr Whytt. But the most valuable of all his works, are his lectures on the *Materia Medica*, which were published in the year 1770, in two volumes 4to. The number of curious and useful facts contained in this book will tend to secure its reputation, although considerable additions and improvements have been made, since that period, in this branch of science. (*Gen. Biog.*)

ALSTON-MOOR, a town in Cumberland, seated on a hill, at the bottom of which runs the river Tyne, with a stone bridge over it. Near this place is plenty of lead ore. W. Long. 2. 4. N. Lat. 54. 45.

ALSTONIA. See BOTANY Index.

Alstroemeria
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Altar.

ALSTROEMERIA. See BOTANY Index.

ALT, in *Music*, a term applied to the high notes in the scale.

ALTAI MOUNTAINS, an extensive range of mountains in the northern parts of Asia. It begins at the vast mountain Bogdo, passes above the head of the Irtysh, and then takes a course, rugged, precipitous, clothed with snow, and rich in minerals, between the Irtysh and Oby; then proceeds by the lake Telezkoi, the rise of the Oby; after which it retires, in order to comprehend the great rivers which form the Jenesei, and are locked up in these high mountains; finally under the name of the *Sainnes*, it is uninterruptedly continued to the lake of Baikal. A branch insinuates itself between the sources of the rivers Onon and Ingoda, and those of Ichikoi, accompanied with very high mountains, running without interruption to the northeast, and dividing the river Amur, which discharges itself into the east, in the Chinese dominions, from the river Lena and Lake Baikal. Another branch stretches along the Olecma, crosses the Lena below Jakoutsk, and is continued between the two rivers Tongouska to the Jenesei, where it is lost in wooded and morassy plains. The principal chain, rugged with sharp-pointed rocks, approaches and keeps near the shores of the sea of Ockhotz, and passing by the sources of the rivers Outh, Aldan, and Maia, is distributed in small branches, which range between the eastern rivers which fall into the Icy sea; besides two principal branches, one of which, turning south, runs through all Kamtschatka, and is broken, from the Cape Lopatka, into the numerous Kurile isles, and to the east forms another marine chain, in the Aleutian islands, which range from Kamtschatka to America; most of them, as well as Kamtschatka itself, distinguished by volcanoes, or the traces of volcanic fires. The last chain forms chiefly the great Cape Tschutski, with its promontories and rocky broken shores.

The summits of the highest of the Altai mountains are covered with perpetual snow. The loftiest range of this extensive chain, is composed of granite. Another range of inferior height consists of shistus, which lies on the side of the granite mountains. Beside these rocks, there are strata of chalkstone, limestone, and marble. The Altai mountains abound in metallic ores. Gold, silver, and lead mines, have been discovered in them, with great abundance of copper and iron. The two latter have been wrought to a considerable extent, and have been found productive.

ALTAMONT, a very handsome town of Italy, in the kingdom of Naples, and in Calabria Citerior, 15 miles north-west of Basignano. E. Long. 16. 22. N. Lat. 39. 40.

ALTAMURA, a town of Naples, in the territory of Bari, with the title of a principality, seated on the foot of the Apennine mountains. E. Long. 16. 54. N. Lat. 41. 0.

ALTAR, a place upon which sacrifices were anciently offered to some deity.

The heathens at first made their altars only of turf; afterwards they were made of stone, of marble, of wood, and even of horn, as that of Apollo in Delos.

Altars differed in figure as well as in materials. Some were round, others square, and others triangular. All of them were turned towards the east, and stood lower

than the statues of the gods; and were generally adorned with sculpture, representing either the gods to whom they were erected, or their symbols. See the PAGAN ALTARS represented on Plate XVII. Upon the sides of fig. 1. a trident and two dolphins are exhibited, which denote it to have been dedicated to Neptune. Fig. 2. a four-square altar, was dedicated to the Nymphs, as the inscription imports. Fig. 3. exhibits a Bacchanal holding a thyrsus in his hand, a mark of the altar's being built to Bacchus; it had two other sides, which made it appear triangular. Of fig. 4. which was also triangular, each face or side exhibited a genius, one of whom (on the side represented) carries an oar upon his neck, which seems to denote it an altar of Neptune. Fig. 5. an altar of a round shape, is inscribed *Ara Neptuni*: the god himself is there represented, all naked, saving the pallium upon his shoulder; and holding in his left hand a trident, and in his right a dolphin.

The height of altars also differed according to the different gods to whom they sacrificed. According to Servius, those altars set apart for the honour of the celestial gods, and gods of the higher class, were placed on some pretty tall pile of building; and for that reason were called *altaria*, from the words *alta* and *ara*, "a high elevated altar." Those appointed for the terrestrial gods were laid on the surface of the earth, and called *aræ*. And, on the contrary, they dug into the earth and opened a pit for those of the infernal gods, which they called *θεοὶ λαγκοί*, *scrobiculi*. But this distinction is not everywhere observed: the best authors frequently use *ara* as a general word, under which are included the altars of the celestial and infernal as well as those of the terrestrial gods. Witness Virgil, Ecl. 5.

—En quatuor aras,

where *aræ* plainly includes *altaria*; for whatever we make of Daphnis, Phœbus was certainly a celestial god. So Cicero, pro Quint. *Aras delubrique Hecates in Græcia vidimus*. The Greeks also distinguished two sorts of altars; that whereon they sacrificed to the gods was called *βωμος*, and was a real altar, different from the other whereon they sacrificed to the heroes, which was smaller, and called *σχαρα*. Pollux makes this distinction of altars in his Onomasticon; he adds, however, that some poets used the word *σχαρα* for the altar whereon sacrifice was offered to the gods. The Septuagint version does sometimes also use the word *σχαρα* for a sort of little low altar, which may be expressed in Latin by *craticula*; being a hearth rather than an altar.

Before temples were in use, altars were erected sometimes in groves, sometimes in the highways, and sometimes on the tops of mountains; and it was a custom to engrave upon them the name, ensign, or character of the deity to whom they were consecrated.

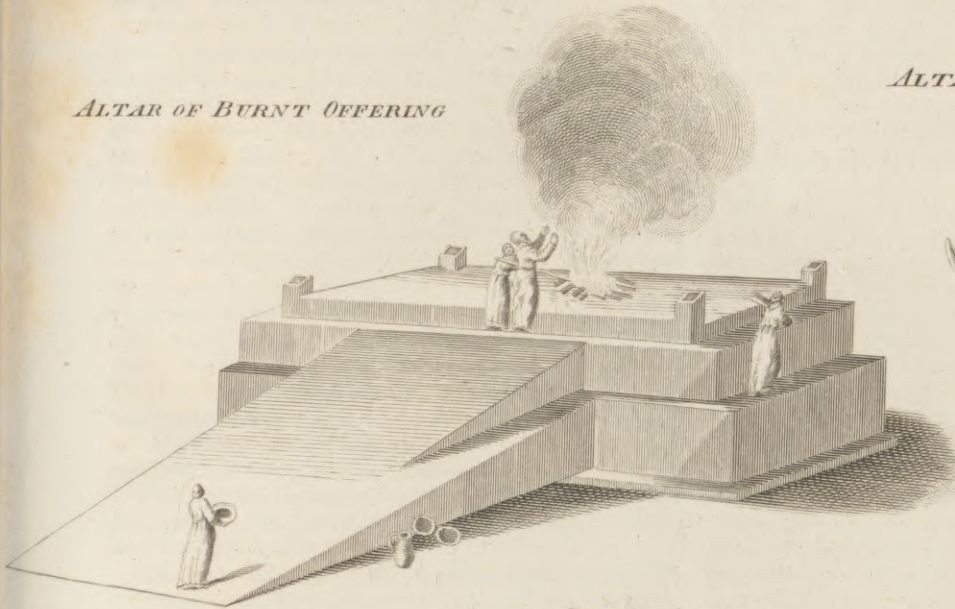
In the great temples of ancient Rome there were ordinarily three altars: The first was placed in the sanctuary, at the foot of the statue of the divinity, upon which incense was burnt and libations offered; the second was before the gate of the temple, and upon it they sacrificed the victims; and the third was a portable altar, upon which were placed the offering and the sacred vessels.

Altar.

Besides

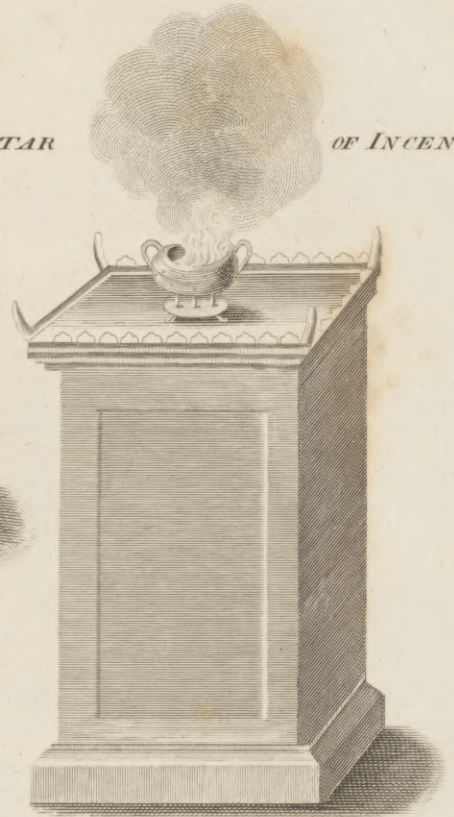
JEWISH ALTARS

ALTAR OF BURNT OFFERING



ALTAR

OF INCENSE



PAGAN ALTARS

Fig. 1.



Fig. 2.



Fig. 4.



Fig. 5.



Fig. 3.



Altar.

Besides these uses of altars, the ancients swore upon them, and swore by them, in making alliances, confirming treaties of peace, and other solemn occasions. Altars also served as places of refuge to all those who fled to them, whatever crime they had committed.

Altars are doubtless as ancient as sacrifices themselves; consequently their origin is not much later than that of the world, Gen. ch. iv. Some attribute their origin to the Egyptians; others to the Jews; others to the patriarchs before the flood. Some carry them as far back as Adam, whose altar is much spoken of by Jewish, and even Christian writers. Others are contented to make the patriarch Enoch the first who consecrated a public altar. Be this as it will, the earliest altars we find any express testimony of are those erected by Abraham.

Altars, in the patriarchal times, were very rude. The altar which Jacob set up at Bethel was nothing but a stone, which served him instead of a bolster; that of Gideon, a stone before his house: and the first which God commanded Moses to erect was probably of earth or unpolished stones, without any iron; for if any use was made of that metal, the altar was declared impure.

The principal altars of the Jews were, The altar of *incense*; that of *burnt-offering*; and the altar, or table, for the *shew bread*.

The altar of *incense* was a small table of shittim wood, covered with plates of gold, of one cubit in length, another in width, and two in height. At the four corners were four kinds of horns, and all round a little border or crown over it. This was the altar hidden by Jeremiah before the captivity; and upon it the officiating priest offered, every morning and evening, incense of a particular composition. See Plate XVII.

The altar of *burnt-offerings* was made of shittim wood, and carried upon the shoulders of the priests by staves of the same wood overlaid with brass. In the time of Moses, this altar was five cubits square and three high; but in Solomon's temple it was much larger, being 20 cubits square and 10 in height. It was covered with brass; and at each corner was a horn or spire, wrought out of the same wood with the altar, to which the sacrifices were tied. Within the hollow was a grate of brass, on which the fire was made; through it fell the ashes, which were received in a pan below. At the four corners of the grate were four rings and four chains, which kept it up at the horns. This altar was placed in the open air, that the smoke of the burnt-offerings might not sully the inside of the tabernacle. See Plate XVII.

The altar or table for the *shew-bread* was likewise of shittim wood, covered with plates of gold, having a little border round it adorned with sculpture. It was two cubits long, one wide, and one and a half in height. Upon this table, which stood in the holy of holies, were put, every Sabbath day, 12 loaves, with salt and incense.

The Jewish altars, after their return from the captivity, and the building of the second temple, were in some respects different from those described above. That of burnt offerings was a large pile, built of unbewn stone, 32 cubits square at the bottom, and 24 square at the top. The ascent was by a gentle rising, 32 cubits in length, and 16 in breadth.

ALTAR, is also used among Christians for the communion-table.

Altar

|| Altenberg.

In the primitive church, the altars were only of wood; as being frequently to be removed from place to place. But the council of Paris, in 509, decreed that no altar should be built but of stone. At first there was but one altar in each church; but the number soon increased; and from the writings of Gregory the Great, who lived in the sixth century, we learn, that there were sometimes in the same church twelve or thirteen. In the cathedral of Magdeburg there are no less than 49 altars.

The altar is sometimes sustained on a single column, as in the subterraneous chapels of St Cecilia, at Rome, &c.; and sometimes by four columns, as the altar of St Sebastian of Crypta Arenaria; but the customary form is, to be a massive of stone work, sustaining the altar table. These altars bear a resemblance to tombs: to this purpose, we read in church-history, that the primitive Christians chiefly held their meetings at the tombs of the martyrs, and celebrated the mysteries of religion upon them: for which reason, it is a standing rule to this day in the church of Rome, never to build an altar, without inclosing the relics of some saint in it.

ALTAR-THANE, or ALTARIST, in old law-books, an appellation given to the priest or parson of a parish, to whom the altarage belonged. See ALTARAGE.

ALTARAGE, in Law, altars erected in virtue of donations, before the Reformation, within a parochial church, for the purpose of singing of mass for deceased friends.

ALTARAGE likewise signifies the profits arising to the priest on account of the altar.

AL-TAYEFF, a town of Hejaz, a district of Arabia Felix. It is situated about 60 miles east of Mecca, behind Mount Gazwan, where the cold is more intense than in any other part of the district, but the air very wholesome. Its territory abounds in fountains, and produces excellent raisins. The town is surrounded with a wall, but is not very large.

ALTDORF, a large handsome town in Switzerland, and the chief of the canton of Uri. It is situated below the lake of the Four Cantons, in a plain, at the foot of a mountain whose passages are difficult, and serve instead of fortifications. It has four churches and two convents; St Martin's church and that of the Holy Cross are the finest. The town-house and the arsenal are also worth seeing. E. Long. 8. 30. N. Lat. 46. 50.

ALTEA, a sea-port town of Valencia in Spain. It was taken in 1705, in favour of the archduke Charles; but lost after the battle of Almanza. W. Long. 0. 15. N. Lat. 46. 34.

ALTEMBURG, a town of Transylvania, 17 miles south-west of Wisemburg, and 35 south of Clausenbourg. E. Long. 23. 5. N. Lat. 46. 25.

ALTENA, or ALTONA, a sea-port town of Germany, in the duchy of Holstein in Lower Saxony. It is a modern town, built by the king of Denmark, and was burnt by the Swedes in 1712; but has since been beautifully rebuilt. The number of inhabitants is about 30,000; and it has a considerable trade. E. Long. 10. 0. N. Lat. 53. 51.

ALTENBERG, an ancient town of Germany, situated

Altenburg situated on the river Pleiss, with a good castle placed on a rock, in Misnia, in the circle of Upper Saxony. It was formerly an imperial city, but at present belongs to the house of Saxony. Here is a college which has always been in a flourishing condition. In 1705, there was a nunnery founded for women of a high rank, who are Protestants. E. Long. 15. 8. N. Lat. 50. 59.

ALTENBURG, a small fortified town of Hungary, in the territory of Moson, near the Danube, about fifty miles from Vienna. E. Long. 17. 20. N. Lat. 48. 15.

ALTENBURG, or **OWAR**, a small but strong town of Hungary, seated in a marsh, with wide streets. It is near the river Danube, and is surrounded with deep ditches. It is 15 miles south of Presburg, 40 south-east of Vienna, and 65 south-west of Buda. E. Long. 17. 56. N. Lat. 46. 50.

ALTERANTS, or **ALTERATIVE Medicines**, such as correct the bad qualities of the blood, and other humours, without occasioning any sensible evacuation.

ALTERATION, in *Physics*, the act of changing the circumstances and manner of a thing; its general nature and appearance remaining the same. Or, it is an accidental and partial change in a body; without proceeding so far as to make the subject quite unknown, or to take a new denomination thereupon. Or, it may be defined, the acquisition or loss of such qualities as are not essential to the form of the body. Thus, a piece of iron, which before was cold, is said to be *altered*, when it is made hot; since it may still be perceived to be iron, is called by that name, and has all the properties thereof. By this, *alteration* is distinguished from *generation* and *corruption*; those terms expressing an acquisition or loss of the essential qualities of a thing. The modern philosophers, after the ancient chemists and corpuscularians, hold all *alteration* to be effected by means of local motion. According to them, it always consists either in the emission, accession, union, separation, or transposition, of the component particles.

ALTERCATION, a debate or contest between two friends or acquaintance. The word comes from *altercari*, which anciently signified to converse or hold discourse together. Thus we say, They never come to an open quarrel, but there is continually some little *altercation* or other.

ALTERN-BASE, in *Trigonometry*, a term used in contradistinction to the true base. Thus in oblique triangles, the true base is either the sum of the sides, and then the *difference* of the sides is called the *altern-base*; or the true base is the difference of the sides, and the *sum* of the sides is called the *altern-base*.

ALTERNATE, in a general sense, a term applied to such persons or things as succeed each other by turns. Thus, two who command each his day, are said to have an alternate command, or to command alternately.

ALTERNATE, in *Heraldry*, is said in respect of the situation of the quarters. Thus the first and fourth quarters, and the second and third, are usually of the same nature, and are called *alternate quarters*.

ALTERNATE, in *Botany*, when the leaves or branches of plants arise higher on opposite sides alternately.

ALTERNATION, in its primary sense, denotes a succession by turns.

ALTERNATION is sometimes used to express the different changes or alterations of orders in any number of things proposed. This is also called *permutation*, &c. and is easily found by a continual multiplication of all the numbers, beginning at unity. Thus, if it be required to know how many changes or alternations can be rung on six bells, multiply the numbers 1, 2, 3, 4, 5, 6, continually into one another; and the last product gives the number of changes.

ALTERNATIVE, is particularly used for the choice of two things proposed. In this sense we say, to take the *alternative* of two propositions.

ALTHÆA, MARSHMALLOW. See *BOTANY Index*.

ALTHEA *Frutex*. See *HIBISCUS*, *BOTANY Index*.

ALTIMETRY, the art of measuring altitudes or heights, whether accessible or inaccessible. See *GEOMETRY*.

ALTIN, a money of account in Muscovy, worth three *copecs*: 100 of which make a ruble, worth about 4s. 6d. sterling.

ALTIN, a lake in Siberia, from whence issues the river Ob, or Oby, in N. Lat. 52. 0. E. Long. 85. 55. This lake is called by the Russians *Teloskoi Osero*, from the Telessi, a Tartarian nation, who inhabit the borders of it, and who give it the name of *Altin-Kul*. By the Calmucks it is called *Altinnor*. It is near 90 miles long and 50 broad, with a rocky bottom. The north part of it is sometimes frozen so hard as to be passable on foot, but the southern part is never covered with ice. The water in the Altin lake, as well as in the rivers which run through the adjacent places, only rises in the middle of summer, when the snows on the mountains are melted by the heat of the sun.

ALTINCAR, among mineralists, a species of factitious salt used in the fusion and purification of metals.

The altincar is a sort of flux powder. Divers ways of preparing it are given by Libavius.

ALTING, HENRY, a German divine, was born at Embden, in 1583. His father was minister of the church of Embden, and early destined his son to the same profession. In the year 1602, after a grammatical course he was sent to the university of Herborn: there he studied with so much assiduity and success, that he soon had the honour of being a preceptor. Qualified by the vigorous exertions of his talents, he was appointed tutor to the three young counts of Nassau, Solms, and Isenburg, who studied with the elector prince palatine, first at Sedan, and afterwards at Heidelberg. A proper discharge of the duties of a lower station generally paves the way for a higher. For he was appointed preceptor to the prince in 1608: and in consequence of his assiduity and success, he was chosen to accompany the elector into England. Among the number of celebrated men to whose acquaintance he was introduced in England, was the famous Dr Abbot, archbishop of Canterbury. In 1613, Alting returning to Heidelberg after the marriage of the elector with the princess of England, received his degree of doctor of divinity, and was appointed director of the college of Wisdom. The increased knowledge and invigorated talents of Alting, were always receiving renewed opportunities of exertion; thus his eloquence

Alting.

quence and learning obtained full scope in the synod of Dort, to which he had been deputed by the Palatinate, along with two other divines.

It was but reasonable for Alting to expect high preferment and high advantages from the avowed patronage of the elector; but in this he was greatly disappointed, and he had only to participate in his misfortunes. In 1622, Count Tilly took the city of Heidelberg, and devoted it to plunder. In order to escape the fury of the soldiers, Alting endeavoured to pass by a back door into the chancellor's house, which was put under a strong guard; but the officer who guarded the house, as he was entering said to him; "with this battle-axe I have to-day killed ten men, and Alting, if I knew where to find him, should be the eleventh; who are you?" Alting with a singular presence of mind returned an evasive answer, which saved his life. "I am (said he) a teacher in the college of Wisdom." The officer took him under his protection; but the Jesuits unfortunately taking possession of the house, the next day, left the generous officer no time at his departure to take care of the teacher of the college of Wisdom." Alting evaded the hands of the Jesuits, by hiding himself in a garret, and a cook of the electoral court supplied him with food, who happened to be employed by Count Tilly in the kitchen occupied by him in the chancellor's house. In this perilous situation he remained until an opportunity offered of making his escape to Heilbron, whither his family had been conducted before.

But ecclesiastical intolerance harassed Alting, as much as he was formerly endangered by military hostility. With the permission of the duke of Wirtemberg he retired for a few months to Schorndorf after the desolation of the Palatinate by the victorious forces of Count Tilly. It was reasonable to expect that a welcome and hospitable reception might have been given, among Protestants, to one who had just escaped the flames of a Popish war. But the doctrine of mutual forbearance and candour seems to have been little attended to by the Protestants, at this period, whatever was their progress in the knowledge of the other doctrines of Christianity. The Palatinate being in the vicinity of the duchy of Wirtemberg, the professors of Tübingen and Heidelberg frequently attacked each other in polemic writings and theological disputations. The natural consequence was, that a settled jealousy and enmity existed between the two schools and their respective vicinities. The injuries which Alting had suffered from the common enemy were not sufficient to secure him a friendly reception among the Lutheran ministers of Schorndorf, who were involved in these feuds, and therefore murmured at the permission which the duke had given to a professor of Heidelberg to reside there. The mischievous effects of religious dissensions have been universally felt.

In 1623, Alting retired with his family to Embden, and afterwards followed to the Hague his late pupil, now king of Bohemia. Such was the unfeigned attachment of his master to him, that he still retained him as a preceptor to his eldest son; and prevented him from accepting the charge of the church at Embden, and likewise of a professorship at the university of Franeker. In 1627 his importunity prevailed upon his patron, and he obtained leave to remove to Groningen, and there ascended the divinity chair; and continued

Alting.

to lecture with increasing reputation until the day of his death. The ardent desire and repeated endeavours of several universities to appropriate to themselves the honour and benefit of his services, is the most unequivocal proof of the general esteem in which his character was held. The states of Groningen positively refused to give their consent to this removal, when the university of Leyden solicited him to come and labour among them. But some time after, the prospect of extensive usefulness in re-establishing the university of Heidelberg, and restoring the churches of the Palatinate, determined him to accept the office of professor of divinity and ecclesiastical senator, presented to him by Prince Lewis Philip. In the year 1634, amidst numerous hardships, to which the existing war exposed him, he set out for Heidelberg, and pursued his journey as far as Frankfurt: when the battle of Norlingen, in which the imperialists were victorious, rendered his farther progress impracticable, and therefore with great difficulty he returned to Groningen.

Domestic affliction and personal sufferings embittered the remaining years of this excellent man's life. Deprived of his eldest daughter by death, such was his great affection for her that it brought on a settled melancholy, attended with a bodily disease which was with great difficulty removed; but after an interval of four years a settled and irrecoverable melancholy seized him, in consequence of the loss of an amiable and beloved wife, which, together with a return of his bodily disease, in a few months put a period to his useful life in the year 1644.

Alting was a man of eminent talents and extensive learning, possessed of amiable dispositions, which induced him to be more solicitous to serve the public than to benefit himself. The amiable character and extensive learning of Alting, cannot fail deeply to interest every reader, in consequence of his misfortunes. He was averse to quarrels and disputes about trifles, although no friend to the innovations introduced at this period by the Socinians. According to his own judgment, adhering to the plain doctrine of Scripture, he was equally desirous to avoid fanatical scrupulosity and sophistical subtlety. The productions of his pen are, *Notæ in Decadem Problematum Jacobi Behm*, Heidelbergæ, 1618; "Notes on a Decad of Jacob Behmen's Problems." *Loci Communes*; "Common Places." *Problemata*; "Problems." *Explicatio Catacheseos Palatinat.*; "Explanation of the Palatine Catechism." *Exegesis Augustanæ Confessionis*, &c. Amst. 1647; "Commentary on the Augustan Confession." *Methodus Theologiæ Didacticæ et Catachetiæ*, Amst. 1650; "A Method of Didactic and Catechetical Theology." *The Medulla Historiæ Prophane*, "Marrow of Profane History," published under the name of Paræus, was written by Alting. (*Gen. Biog.*)

ALTING, James, son of Henry Alting, was born at Heidelberg in 1618. After the usual course of grammatical studies, he became a student, and soon after professor of divinity in the university of Groningen. The Oriental languages were his favourite studies at an early period of his life; and in 1638 he put himself under the tuition of a Jewish rabbi at Embden. Determining to take up his residence in England, he arrived there in 1640, and was admitted to clerical orders, by Dr Prideaux bishop of Worcester. By

Alting,
Altitude.

an offer of the Hebrew professorship in the university of Groningen, he was soon induced to alter his plan of life, and consequently again returned to Germany in 1643. His active assiduity in these languages, and his knowledge in other sciences, procured him universal esteem, and great reputation as a scholar. About this time he received many academic honours; he was admitted doctor of philosophy, academic preacher, and at last in conjunction with a colleague, Sanuiel des Marets, was chosen professor of divinity. These professors followed different methods of teaching, and adopted different systems. Des Marets was an admirer and follower of the subtilities of the scholastics; and by the ingenuity with which he pursued the scholastic plan of instruction had acquired great reputation and considerable influence. Alting spent his time in the study of the Scriptures, and in the pursuit of Rabbinical learning; and he delivered a course of lectures on divinity, which gained him great popularity. As it might naturally be expected, a mutual jealousy arose between the two professors: and their respective partisans in the university carried their animosity to an undue height. Established opinion, and the weight of authority, marshalled on the side of Des Marets. By the permission of the curators of the university he appeared as public accuser of Alting, and produced a long list of erroneous propositions to the divines of Leyden for their opinion. The judgment of the divines upon the dispute shows a great degree of moderation and good sense: they pronounced Alting innocent of heresy, but imprudently fond of innovation; and they declared Des Marets deficient in modesty and candour. If the superiors had not prohibited the farther discussion of these subjects in the consistories, classes, and synods, they would have occasioned as much mischief as they had excited general attention. Such was the protection given to Alting, that whenever any of the order of ecclesiastics proposed any further measures against him, they were immediately rejected by the civil power; nay, the penalty of deprivation was decreed against those clergy who should revive the *Maresio-Altingian* controversy. Whatever might be the advantages resulting to Alting from this protection, the magistrates certainly did wrong in proceeding so far in prohibiting a free discussion from the press, either for or against the judgments of the divines of Leyden. Although a kind of reconciliation was attempted by their common friends while Des Marets lay upon his death-bed, yet the breach between Des Marets and Alting was never perfectly healed. Dr Alting died of a fever in 1679. The fondness which he shewed for Rabbinical learning gave birth to the general report, that he was inclined to become a Jew. His opinions, which seem to have excited more general attention than they deserve, may be seen at large in his writings, which were collected a few years after his death, and published in five volumes folio, by his cousin Menso Alting, who wrote a good description of the Low Countries, under the title of *Notitia Germaniæ Inferioris*. (*Gen. Biog.*)

ALTITUDE, accessible and inaccessible. See **GEO-METRY**.

The method of taking considerable terrestrial altitudes, of which those of mountains are the greatest, by means of the barometer, is very easy and expeditious.

It is done by observing, on the top of the mountain, how much the mercury has fallen below what it was at the foot of the mountain. See **BAROMETER**.

ALTITUDE of the Eye, in Perspective, is a right line let fall from the eye, perpendicular to the geometrical plane.

ALTITUDE, in *Astronomy*, is the distance of a star, or other point in the mundane sphere, from the horizon.

This altitude may be either *true* or *apparent*. If it be taken from the rational or real horizon, the altitude is said to be true or real; if from the apparent or sensible horizon, the altitude is apparent. Or rather, the apparent altitude is such as it appears to our observation; and the *true* is that from which the refraction has been subtracted.

The true altitudes of the sun, fixed stars, and planets, differ but very little from their apparent altitudes; because of their great distance from the centre of the earth, and the smallness of the earth's semidiameter, when compared thereto. But the difference between the true and apparent altitude of the moon is about 52. This subject is further explained under **ASTRONOMY**.

ALTITUDE Instrument, or Equal Altitude Instrument, is that used to observe a celestial object when it has the same altitude on the east and west sides of the meridian. See **ASTRONOMY**.

ALTKIRK, a town of France, in the department of the Upper Rhine, situated on the river Ill, in N. Lat. 47. 40. E. Long. 7. 15.

ALTMORE, a town of Ireland, in the county of Tyrone, and province of Ulster, situated in N. Lat. 54. 34. W. Long. 7. 2.

ALTON, a town in Hampshire, seated on the river Wey; W. Long. 0. 46. N. Lat. 51. 5. It is governed by a constable, is indifferently built, being chiefly laid out in one pretty broad street, and contained 2316 inhabitants in 1811. It has one church, a Presbyterian and a Quaker meeting, a famous free school, a large manufacture of plain and figured baragons, ribbed druggets, and serges de Nismes; and round the town is a large plantation of hops.

ALTON, or **AVELTON**, a village in Staffordshire, five miles north of Uttoxeter. There are the ruins of a castle here, which some would have to be built before the Norman conquest; but Dr Plott is pretty certain that it was erected by Theobald de Verdun, in the beginning of the reign of Edward II. A great part of the walls are still standing, but they are in a very ruinous condition.

ALTO Basso, or in *ALTO et in Basso*, in *Law*, signifies the absolute reference of all differences, small and great, high and low, to some arbitrator or indifferent person. *Pateat universis per presentes, quod Wilhelmus Tylar de Yetton, et Thomas Gower de Almestre, posuerunt se in Alto et in Basso, in arbitrio quatuor hominum; viz. de quadam querela pendente inter eos in curia. Nos et terram nostram altè et bassè ipsius domini Regis supposuimus voluntati.*

ALTO-Relievo. See **RELIEVO**.

ALTO-Repieno, in *Music*, the tenor of the great chorus, which sings and plays only now and then in some particular places.

ALTORF, a town of the circle of Franconia, in Germany.

Altitude
||
Altorf.

Alt-Ran-
stadt
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Alva.

Germany. It has a botanical garden, with a great variety of plants, an anatomical theatre, a handsome library, and contained 2070 inhabitants in 1803. It is subject to the house of Bavaria, and is 15 miles from Nuremberg. E. Long. 11. 7. N. Lat. 49. 25.

ALT-RANSTADT, a town in Saxony, famous for the treaty between Charles XII. king of Sweden and Augustus elector of Saxony, in 1706, wherein the latter resigned the kingdom of Poland.

ALTRINGHAM, a town of England, in Cheshire, seven miles from Manchester, and containing 2032 inhabitants in 1811. W. Long. 1. 30. N. Lat. 53. 25.

ALTZEG, a town of Germany, in the Lower Palatinate, the capital of a territory of the same name, with an old castle. W. Long. 7. 25. N. Lat. 49. 44.

ALVA DE TORMES, a considerable town in Spain, in the kingdom of Leon, and territory of Salamanca, with a very handsome castle. It is seated on the north bank of the river Tormes. W. Long. 6. 1. N. Lat. 41. 0.

ALVA, *Ferdinand Alvarez of Toledo, duke of*, was born in 1508, and descended from one of the most illustrious families in Spain. His grandfather, Frederick de Toledo, was his preceptor in the military and political arts, and he displayed his valour at the battle of Pavia and at the siege of Tunis. The ambitious Charles V. selected Alva as a proper instrument for conducting his military enterprises, and he made him his general in 1538; and, after several operations, in which he both displayed his valour and military knowledge, in 1542 he successfully defended Perpignan against the dauphin of France.

In 1546, Alva was made general in chief of the army which marched against the German Protestants, who were marshalled under the banners of the elector of Saxony. Francis, the king of France, died at Rambouillet, and by his death a considerable change was made in the state of Europe. Instantly, therefore, Charles began his march from Egra on the borders of Bohemia, and entered the southern frontier of Saxony, and attacked Altorf upon the Elster. Incessantly pushing forward, he arrived the evening of the 23d of April on the banks of the Elbe, opposite to Muhlberg. The river, at that place, was three hundred paces in breadth, about four feet in depth; its current rapid; and the bank possessed by the Saxons was higher than that which he occupied. In opposition to the opinion of the duke of Alva and his other officers, Charles, with undaunted courage, and with inexpressible difficulties, led his army through the river and engaged the Saxons. The elector displayed great personal courage and military knowledge, but having received a wound in the face, he at last surrendered himself prisoner. When he approached the emperor, he said, "The fortune of war has made me your prisoner, most gracious emperor, and I hope to be treated"—Here Charles harshly interrupted him, "And am I then at last acknowledged to be emperor; Charles of Ghent was the only title you lately allowed me. You shall be treated as you deserve." The elector made no reply; but, with an unaltered countenance, which discovered neither astonishment nor dejection, accompanied the Spanish soldiers appointed to guard him. The emperor proceeded towards Wittemberg, whither

the remains of the Saxon army had fled, carrying along with him the captive prince, as a spectacle of consternation and amazement to his own subjects. But when he approached the town, he found it defended by the vigorous efforts of the elector's wife, along with the inhabitants. He summoned Sibylla once and a second time to open the gates, informing her, that if she persisted in her obstinacy, the elector should answer for it with his head. Accordingly he brought his prisoner to an immediate trial. The proceedings against him were as irregular as the stratagem was barbarous. Instead of consulting the states of the empire, or remitting the cause to any court, which, according to the German constitution, might have legally taken cognizance of the elector's crime, he subjected the greatest prince in the empire to the jurisdiction of a court martial. The emperor selected the unrelenting duke of Alva as a proper instrument to carry into effect any measure of violence and oppression, and therefore made him president of that court, composed of Spanish and Italian officers. Moved more by the intreaties of his wife than by a sense of his own danger, the elector submitted to all the rigorous and unjust measures that were proposed in order to save his life; but when it was added, that he should also renounce the Protestant faith and become a Roman Catholic, he refused to act in opposition to his conscience, and bravely fell a sacrifice to the cause of truth.

In 1552, Alva was intrusted with the command of the army intended to invade France, and was constrained by the opinion and authority of the emperor to lay siege to Mentz, in opposition to his own military knowledge; but notwithstanding all his valour and abilities, the duke of Guise successfully defended the place. In consequence of the success of the French arms in Piedmont, he was made commander in chief of all the emperor's forces in Italy, and at the same time invested with unlimited power. Success did not, however, attend his first attempts, and after several unfortunate attacks, he was obliged to retire into winter quarters. The next year he was sent into the pope's territories, and, had he not been restrained by his master, he would have taken possession of all his fortified places, and deterred Henry from entering into any new connection with him, and have thereby prevented the renewal of the war. Philip was strongly inclined to peace, but Alva was inclined to severe measures: he, however, yielded to the instructions of his master, until being deluded, and sometimes haughtily answered, he at length sent Pino de Loffredo with a letter to the college of cardinals, and another to Paul, in which, after enumerating the various injuries which his master had received, and renewing his former offers of peace and friendship, he concluded with protesting that, if his offers were again rejected, the pope should be chargeable with all the calamities that might follow. The pope threw Loffredo into prison; and, had not the college of cardinals interposed, he would have even put him to death; and on account of Philip's failing to pay tribute for Naples, he deprived him of the sovereignty of that kingdom. This violent conduct of Paul gave great offence throughout all Europe, and greatly lessened his influence in Italy; but Philip, though a young, ambitious, powerful monarch, and of a temper of mind impatient of injuries and affronts,

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moved with a religious veneration, discovered an amazing reluctance against proceeding to extremities. After much time spent in negotiation, Philip was at last forced to give orders for Alva to take the field. He cheerfully obeyed, and began his march in the beginning of September 1556, with a well-disciplined army, which reducing several towns in the Campagna di Roma, he pursued his conquests to the very gates of Rome. The circumstances, however, in which Alva found his army, induced him to make a truce of forty days, and after several negotiations, he yielded to peace. One of its terms was, that the duke of Alva should in person ask forgiveness of the haughty pontiff whom he had conquered. Proud as the duke was by nature, and accustomed to treat with persons of the highest dignity, yet such was the superstitious veneration then entertained for the papal character, that he confessed his voice failed him at the interview, and his presence of mind forsook him. Not long after this, he was sent at the head of a splendid embassy to Paris, to espouse, in the name of his master, Elizabeth, daughter of Henry king of France.

Philip II. his new master, being strongly devoted to the Roman see, and determined to reclaim rebels to his government, and dissenters from his faith, by the most unrelenting severity and unbounded cruelty, he pitched upon Alva as the fittest person to carry this system into practice: with this design, therefore, he was sent into the Low Countries in 1567. Having received his orders, armed with such power as left only the shadow of authority to the natural governor, and provided with 10,000 veterans, he marched towards that devoted country. When he arrived, he soon shewed how much he merited the confidence which his master reposed in him, and instantly erected a bloody tribunal, to try all persons who had been engaged in the late commotions which the civil and the religious tyranny of Philip had excited. The depraved enormities of the mind of Alva, raged with unexampled violence. He imprisoned the counts Egmont and Horn, the two popular leaders of the Protestants, and soon brought them to an unjust trial, and condemned them to death. In a little time, he totally annihilated every privilege of the people, and with uncontrolled fury and cruelty, put multitudes of them to death. Beholding herself deprived of all authority, and her subjects devoted to destruction, the duchess of Parma resigned her office, disdaining to hold the nominal, while the actual reins of power were in the hands of Alva. This event increased the general tide of wretchedness, and every place was filled with scenes of horror and dismay. Unable for the present to administer the least aid, the prince of Orange saved his life by flight. This noble prince suddenly collected an army in Germany, and returned to the relief of his countrymen; and at the same time Prince Lewis, his brother, marched with an army into Friesland. Although success at first attended Lewis, yet the activity and experience of Alva prevailed, and he was totally defeated. The prince of Orange proved a more formidable foe; and it gave exertion to the united talents of Alva, and his son Frederick of Toledo, to prevent the prince from making a descent upon the Netherlands. But notwithstanding all the address and military skill of the prince of Orange, this was effected;

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and the glory remained to Alva to baffle that great leader, and to compel him, after great loss of men, to disband the remainder of his army. Now the cruelty of Alva had unrestrained vent. Instantly the executioner was employed in removing all those friends of freedom whom the sword had spared. Uncontrolled, the base and unrelenting heart of Alva began to reduce all the provinces to utter slavery, and to extirpate Protestantism in that country. In most of the considerable towns, Alva built citadels. He erected a statue of himself, which was no less a monument of his vanity than his tyranny, in the city of Antwerp: he was figured trampling on the necks of two smaller statues, representing the two estates of the Low Countries. By his unusual and arbitrary requisition of new supplies from the states, he greatly aggravated this haughty insult. The human mind displays unusual vigour when rendered desperate by oppression. The exiles from the Low Countries, roused to action, fitted out a kind of piratical fleet, and, after strengthening themselves by successful depredations, ventured upon the bold exploit of seizing the town of Briel. Thus, unintended by him, the cruelty of Alva was the instrument of the future independence of the seven Dutch provinces. The fleet of the exiles having met the Spanish fleet, totally defeated it, and reduced North Holland and Mons; and numbers of cities hastened to throw off the yoke: while the states-general assembling at Dordrecht, openly declared against Alva's government, and marshalled under the banners of the prince of Orange. This situation of affairs opened the eyes of Alva to behold the instability of a power founded on terror and oppression; he therefore began in vain to use more lenient measures. He prepared, however, with vigour to oppose the gathering storm, and afterwards recovered Mons, Mechlin, and Zutphen, under the conduct of his son Frederick, where his soldiers more than retaliated upon the prince of Orange. With the exception of Zealand and Holland, he regained all the provinces; and at last his son stormed Waerden, and, massacring its inhabitants with the most savage cruelty, he then proceeded to invest the city of Haerlem. Fully convinced of the miseries that waited their surrender, this city stood an obstinate siege; and nothing less than the inflexible and persevering spirit of Alva could have opposed difficulties almost insurmountable. Despairing of success, Frederick was at one time disposed to raise the siege, but the stern reproaches of his father urged him on; and at length the inhabitants, overcome with fatigue and resistance, surrendered. The victorious Frederick gave tolerable conditions to the town; but his cruel father arriving on the third day after the surrender, sacrificed numerous victims, who had been led to expect mercy, and satiated his vengeance to the full. Their next attack was upon Alkmaar; but the spirit of desperate resistance was raised to such a height in the breasts of the Hollanders, that the Spanish veterans were repulsed with great loss, and Frederick constrained reluctantly to retire. Alva now resolved to try his fortune by sea, and with great labour and expence fitted out a powerful fleet, and proceeded to attack the Zealanders, but was entirely defeated, and the commander taken prisoner. About the same period, the prince of Orange proceeded to attack the town of Gertruydenberg. Alva's feeble

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Alva. state of health and continued disasters induced him to solicit his recall from the government of the Low Countries; a measure, which in all probability, was not displeasing to Philip, who was now resolved to make trial of a milder administration. In December 1573, that devoted country was freed from the presence and oppressions of the duke of Alva, who, accompanied by his son, returning home, gave out the inglorious boast, that he had, during the course of six years, besides the multitudes destroyed in battle and massacred after victory, consigned 18,000 persons to the executioner. Requesens, who succeeded him in the command, in his first act of administration, pulled down his insolent effigies at Antwerp, so that nothing might remain of him in that much injured country but the remembrance of his injustice and cruelty.

Returning from this scene of oppression and blood, he was treated for some time with great distinction by his master. Justice, however, soon overtook the crimes of Alva: for his son having debauched one of the king's attendants, under promise of marriage, he was committed to prison; and being aided in his escape by his father, and married by him to a cousin of his own, this procured Alva's banishment from court, and confinement in the castle of Uzeda. He remained two years in this disgraceful situation, until the success of Don Antonio, in assuming the crown of Portugal, determined Philip to turn his eyes towards a person, in whose fidelity and abilities he could on this occasion most confide. A secretary was instantly dispatched to Alva, to make inquiries concerning the state of his health, and whether or not it was sufficiently vigorous to undertake the command of an army. The aged chief returned an answer full of loyal zeal, and was immediately appointed to the supreme command in Portugal. It is a singular fact, however, that the enlargement and elevation of Alva was not followed by forgiveness. It is a characteristic mark of the unrelenting temper of Philip, and, at the same time, a noble testimony to the honour and loyalty of Alva, that although placed in this important trust, he did not procure his pardon. In 1581, Alva entered Portugal, defeated Antonio, drove him from the kingdom, and soon reduced the whole under the subjection of Philip. Entering Lisbon, he seized an immense treasure; and with their accustomed violence and rapacity, he suffered his soldiers to sack the suburbs and vicinity. It is reported, that Alva being requested to give an account of the money expended on that occasion, he sternly replied, "If the king asks me for an account, I will make him a statement of kingdoms preserved or conquered, of signal victories, of successful sieges, and of sixty years service." Philip deemed it proper to make no farther inquiries. Alva, however, did not enjoy the honours and rewards of his last expedition, for in 1582, at the age of 75, he was removed by death to the impartial tribunal of heaven, to receive the just rewards of his iniquitous life.

The actions already enumerated give such an ample idea of his character, that little more is necessary to complete it. In him a variety of extremes concurred. Some of the best qualities of a commander were blended with some of the worst that ever existed in a man or in a general. The Spanish severity, little tempered by the spirit of generosity, appeared in all

its horrible deformity in Alva. A strict impartial discipline was his greatest military virtue, and vanity was his greatest weakness. In consequence of this strict discipline, he sometimes punished the unlicensed barbarities of his soldiers; and there is an instance recorded, that when his favourite son Frederick, thinking he could attack the prince of Orange with advantage, sent a request to his father for permission, he received a stern reprimand, for presuming to exercise his judgment on a point already determined by his superior, with a threatening in case of repetition. (*Gen. Biog.*)

ALVAH, the wood wherewith Moses sweetened the waters of Marah, Exod. ch. xv. ver. 25.—The name of this wood is not found in Scripture; but the Mahometans give it that of *alvah*, and pretend to trace its history from the patriarchs before the flood. Josephus, on the contrary, says, that Moses used the wood which he found next lying before him.

ALVARES DE LUNA, treasurer, and a great favourite of John II. king of Castile, was famous for the prodigious ascendancy he gained over this prince, and for the punishment which at length overtook him. He was a natural son of Don Alvaro de Luna, lord of Canete in Aragon, and of a woman of infamous character. He was born in 1388, and named Peter; but Pope Benedict XIII. who was charmed with his wit though yet a child, changed Peter to Alvares. He was introduced to court in 1408, and made a gentleman of the bedchamber to King John, with whom he grew into the highest favour. In 1427 he was obliged to retire: the courtiers exerted all their endeavours to ruin him: they complained, that a man of no military skill, of no virtues whatever, should by mere artifice and dissimulation, be advanced to the highest authority; and they could not bear, that by the assistance of a few upstart men, whom he had raised and fixed to his interest, he should reign as absolutely as if he were king.

They prevailed against him, and Alvares was banished from court a year and a half: but this was the greatest affliction imaginable to the king; who showed all marks of distress the moment he was removed from his presence, and now thought and spoke of nothing but Alvares. He was therefore recalled; and, being invested with his usual authority, revenged himself severely upon his enemies, by persuading the king to banish them. Of the 45 years he spent at court, he enjoyed for 30 of them so entire an ascendancy over the king, that nothing could be done without his express orders: nay, it is related by Mariana, that the king could not change an officer or servant, or even his clothes or diet, without the approbation of Alvares. In short, he wanted nothing to complete his grandeur but the name of king: he had all the places in the kingdom at his disposal; he was master of the treasury, and by bounties had so gained the hearts of the subjects, that the king, though his eyes were now opened, and his affections sufficiently turned against him, durst not complain.

But the day of reckoning was approaching, and at length he was seized; yet not directly, openly, and violently, but with some of that management which upon a similar occasion was formerly employed by Tiberius against Sejanus. During his confinement, he made

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several attempts to speak to the king in person; but not being able to effect this, he sent the following letter, from which, as well as from the rest of Alvarez's history, all court favourites may draw abundant matter for edification and instruction. "Sir, It is five and forty years since I was admitted into your service. I do not complain of the rewards I have received: they were greater than my merits or expectation, as I shall not deny. There was but one thing wanting to complete my happiness; and that was, to have fixed proper limits in time to this great fortune of mine. While, instead of choosing retirement, after the example of the greatest men, I still continued in the employment, which I thought not only my duty, but necessary for your interest, I fell into this misfortune. It is very hard that I should be deprived of liberty, when I have risked life and fortune more than once to restore it to you. Grief prevents me from saying more. I know that the Deity is provoked against me by my sins; but it will be sufficient for me, if his anger is appeased by the calamities I now suffer. I can no longer bear that prodigious mass of riches, which it was wrong in me to have heaped together. I should willingly resign them, but that every thing I have is in your power; and I am denied the opportunity of showing mankind, that you have raised a person to the height of greatness, who can condemn wealth as well as procure it, and give it back to him from whom he received it. But I desire you by the strongest terms, that, as I was obliged by the lowness of the treasury, to raise 10,000 or 12,000 crowns by methods I ought not to have taken, you will restore them to the persons from whom they were extorted. If you will not grant this on account of the services I have done, yet I think it necessary to be done from the reason of the thing."

This letter, however, produced no effect in his favour: Alvares was tried, and condemned to lose his head. After condemnation, he was removed to Valladolid; and having confessed himself, and received the sacrament, he was carried upon a mule to the market-place, in the middle of which a large scaffold was erected. Mounting the scaffold, he paid reverence to the cross, and presently gave his hat and signet to his page, saying, "These are the last gifts you will ever receive from me." He then submitted himself to the axe with the utmost intrepidity.

ALVAREZ, FRANCIS, a Portuguese priest, and almoner to Emanuel king of Portugal, flourished about the beginning of the 16th century. He was sent ambassador from Portugal to David prince of Abyssinia; and after a residence of six years in that country, returned with letters of friendship from David to Juan, who had succeeded Emanuel, and of submission to Pope Clement VII. At Bologna, in the year 1523, he gave a narrative of his expedition to the pope, in the presence of the emperor Charles V. In the year 1540, he published the relation of his journey in one volume folio, in the Portuguese language. He gives a plain and accurate description of this empire; and we are indebted to him for the first of the kind that ever was published. This work was translated into Latin, under the title of *De Fide, Regione, Moribus Ethiopum*, by Damien Goetz, a Portuguese gentleman; and

has often been reprinted and translated into other languages. The information of Alvarez is not, however, to be received with implicit credit, because he does not always speak from his own observation, and he frequently exaggerates. (*Dict. Hist.*)

ALUDELS, in the older and more complicated chemical apparatus, were earthen pots without bottoms, inserted into each other, and used in sublimations.

ALVEARIUM, in *Anatomy*, the bottom of the *concha*, or hollow of the outer ear.

ALVEARIUM also signifies a bee-hive. The word is formed of *alveus*, "channel or cavity," in allusion to the *alveoli* or cells in bee-hives.

Some of the ancients use also the word *alvearium* for a bee-house, more usually called among us *apiary*.

ALVEARIUM is sometimes also used figuratively, to denote a collection; in which sense, *alvearium* amounts to much the same with what we otherwise call *thesaurus*, *cornucopia*, or the like. Vinc. Boreus has published an *alvearium* of law.

ALVEOLUS, in *Natural History*, the name of the waxen cells in bee-hives. Also the name of a sea fossil of a conic figure, composed of a number of cells like bee-hives, joined into each other with a pipe of communication.

ALVEOLUS, in *Anatomy*, the sockets in the jaws wherein the teeth are fixed. Some writers speak of teeth growing without alveoli. Pliny mentions a person who had a tooth in his palate. Eustachius relates that he saw a man at 60 who had a tooth growing out of the middle of his fauces. Haller gives an instance of a person whose teeth were of a piece with his jaws, without any insertion into alveoli.

ALVIANO, BARTHOLOMEW, a Venetian general, flourished in the beginning of the 16th century. His talents were well calculated for the conduct of military affairs, and in the early part of his life, raised him to great reputation. In the year 1508, he gained such signal victories over the emperor Maximilian, that he was decreed triumphal honours by the republic. During the famous league of Venice, he was second in command along with Count Pitigliano. It was, however, unfavourable to the cause in which they had engaged, that the tempers of the two commanders were very different. The commander in chief was hesitating and cautious. The other was bold and intrepid. Alviano commanded the rear-guard at the famous battle of Aignadel, and after displaying the greatest exertions of valour was wounded, overpowered, and at last taken prisoner. An increasing tribute was paid to the military talents of Alviano; for after the Venetians had become the allies of France, he was intrusted with the command of their army. When the emperor attacked Padua, he defended it against him, and displayed numerous acts of valour in repulsing the imperial troops. But the current of human life runs not equally smooth on its attendance upon any character; for he lost the great battle of La Motte, in which, however, his exertions were so conspicuous, that the senate gave him the most honourable assurance of the continuance of their esteem. Fortune, however, soon became propitious to this great man, and he defeated the enemy in Friuli. In the desperate battle of Marignano, he afforded such timely aid to Francis I. that it greatly contributed to his success. But the most vigorous

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gorous constitution must one day yield to the force of constant exertions, and the most incessant fatigue: he had incurred such hardships in superintending the works at the siege of Breccia, that he was seized with a fever, of which he died at the advanced age of 60. His character stands high in the annals of military fame. By a strict observance of discipline, and a profuse liberality to his soldiers, he secured their esteem. As an unequivocal proof of this, they kept his body unburied twenty-five days, carrying it about with them during their marches with all funeral pomp. His loss was deeply regretted by the state, and, as a proof thereof, his body was buried at the public charge, his unprovided family was supported by a liberal pension, and his daughters were portioned by the state. (*Gen. Biog.*).

ALUM, in *Chemistry*, a clear and transparent saline matter, usually sold in large masses, of a very austere and astringent taste, useful in medicine and in various arts.

Most of the alum to be met with is artificially prepared by the methods related in their proper place under the article *CHEMISTRY*, or by others similar to them: though sometimes a small quantity is produced naturally. This native alum is mixed with heterogeneous matters, or effloresces in various forms upon the ores during calcination. It rarely occurs in a crystallized state, though thus it is said to be met with in Egypt, Sardinia, Spain, Bohemia, and other places. It is also found in waters impregnated with fixed airs, but very seldom in fountains or hot medicated waters.

There are several kinds of alum to be met with; but these differ from one another only in being mixed with some salts which are not of the aluminous kinds. That called the Roman alum has been considered as preferable to any other. This is usually met with in small crystals, and has a reddish colour, most probably owing to a small quantity of calx of iron, which, however, does not in the least impair its qualities. The other kinds of alum contain a portion either of vitriolated tartar or sal ammoniac, according to the nature of the alkali used in its preparation. Mr Bergman informs us, that the vegetable alkali, if pure, does not hurt the alum, though it be added in the preparation; but that the volatile alkali, by adulterating it with a portion of vitriolic sal ammoniac, renders it unfit for some purposes. The alum, made by adding a portion of clay to the liquor at the beginning of the boiling, he considers as equal, if not superior, to Roman alum. He informs us also, that a kind of alum some time ago began to be manufactured at Brunswick, which was equal in quality to the Roman alum. On a chemical analysis of this alum he found it mixed with cobalt.

This salt is extremely useful in the art of dyeing; as by means of it a great number of colours are fixed and rendered permanent upon cloth, which otherwise would either not adhere in any degree, or only for a very short time. In what manner this is accomplished, we are very much ignorant; the conjectures and theories on this subject are related under the article *DYEING*. It constitutes the basis of crayons, which generally consist of the earth of alum finely powdered and tinged for the purpose. In the preparation of Prussian blue, it prevents the basis of martial vitriol, which is soluble in acids, from being precipitated by the superfluous alkali

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employed in the preparation of that pigment; that is, the alkali which is not coloured by the saturating matter. As this basis adheres more strongly than the clay to the vitriolic acid, and would form a green by the mixture of its yellowness, the white earth of alum likewise, according to its quantity, dilutes the darker colours, even black itself, and produces an infinite number of shades. It is also of use in the making of candles: for, being mixed with the tallow, it gives it a hardness and consistence which it has not naturally. Wood sufficiently soaked in a solution of alum does not easily take fire; and the same is true of paper impregnated with it; which, for that reason, is very properly employed in preserving gunpowder, as it also excludes the moisture of the air. Paper impregnated with alum is useful in whitening silver, and silvering brass without heat. Alum is also of use in tanning, where it assists in restoring the cohesion of the skins, almost entirely destroyed by the lime. Vintners fine down their wines, &c. with alum; fishers use it to dry cod fish with; and bakers have mixed it with the flour to make their bread compact and white: to this last use of it great objections have been made; but unjustly, for it is entirely innocent. It is now seldom used.

In medicine it is of considerable use as an astringent and tonic. It is reckoned particularly serviceable for restraining hemorrhages, and immoderate secretions from the blood; but less proper in intestinal fluxes. In violent hemorrhages, it may be given in doses of 15 or 20 grains, and repeated every hour or half hour till the bleeding abates: in other cases, smaller doses are more advisable; large ones are apt to nauseate the stomach, and occasion violent constipations of the bowels. It is used also externally, in astringent and repellent lotions and collyria. Burnt alum taken internally has been highly extolled in cases of colic. In such instances, when taken to the extent of a scruple for a dose, it has been said gently to move the belly, and give very great relief from the severe pain. Its official preparations are, for internal use, *pulvis stypticus*, and *aqua styptica*; for external applications, the *aqua aluminis*, and *coagulum aluminis* and *alumen ustum*; which last is no other than the alum dried by fire, or freed from the watery moisture, which, like other salts, it always retains in its crystalline form. By this loss of its water it becomes sharper, so as to act as a slight escharotic; and it is chiefly with this intention that it is employed in medicine, being very rarely taken internally. For these preparations, see *PHARMACY*. See also *ALUM*, SUPPLEMENT.

ALUM Mines are said to have been first found in Italy in the year 1460; and in 1506 King Henry VII. made a monopolizing grant of this commodity to Augustine Chigi, a merchant of Sienna. In the year 1608, the manufacture of alum was first invented, and successfully practised in England, meeting with great encouragement in Yorkshire, where it was first made, from Lord Sheffield, and the other gentlemen of that county. King James I. by advice of his ministry, assumed the monopoly of it to himself, and therefore prohibited the importation of foreign alum; and in 1625 the importation of it was further prohibited by the proclamation of Charles I.

ALUM-Works, places where alum is prepared, and manufactured in quantities for sale. They differ from
alum.

Aluminium alum mines, as in the former an artificial alum, and in the latter natural alum, is produced.

ALUNTIIUM, ALONTIUM, in *Ancient Geography*, a town in the north of Sicily, situated on a steep eminence, at the mouth of the Chydas; said to be as old as the war of Troy. It is now in ruins; and from these has arisen the hamlet *St Philadelfo*, in the Val di Demona. The inhabitants were called *Haluntini*.

ALVUS, in *Anatomy*, a term used for the belly in general, but more frequently applied to the bowels.

ALWAIDII, a sect of Mahometans who believe all great crimes to be unpardonable.—The Alwaidii stand in opposition to the Morgii. They attribute less efficacy to the true belief in the salvation of men than the rest of the Mussulmans.

ALYPIUS of Antioch, a geographer of the fourth century. He was sent deputy-governor by the emperor Julian into Britain; and after he remained in this situation for some time, he received orders from the emperor to rebuild the temple of Jerusalem. Ammianus Marcellinus, the Roman historian, informs us, that during the progress of the work, whilst it was proceeding with great rapidity, huge balls of fire issued forth in the vicinity of the foundations, which interrupted the men at their labour, and even sometimes consumed them with its violence. Thus the place being rendered inaccessible, they were reluctantly constrained to desist from their undertaking. Different sentiments have been entertained of this phenomenon; but the reader may consult, for his own satisfaction, what has been written by Lardner and Gibbon concerning it. In the evening of his life, after he had retired from the service of the public, Alypius, in conjunction with several other persons, was formally accused of the crime of practising magic. In consequence of which, he was punished with banishment and confiscation of property, and Hierocles his son was condemned to capital punishment. Ammianus Marcellinus, whilst he mentions that the crime for which they suffered, was that of administering poison to others, at the same time freely delivers his opinion, that they were the victims of the general injustice and oppression which reigned at that period, and extended their sway even to the most retired habitations. The emperor Julian himself honoured Alypius with his confidence, and speaks of him with great respect. "As to your conduct in public affairs (says the emperor), it gives me pleasure to observe the assiduity and humanity which appear in all your transactions; for so to temper lenity and moderation with firmness and fortitude, that the good may experience the benefit of the former, and the bad may be corrected by the latter, requires no small share of ability and virtue." Alypius composed a geographical work which is said to have gained the approbation of the emperor, but this work has shared the same fate as many other productions of antiquity. Some have ascribed the work which Godfrey published under the title of "A Description of the Old World;" printed in 4to, at Geneva, to Alypius; but since that author speaks of Britain, not merely from report, but his own observation; this, together with the testimony of some writers, leads to the conclusion, that this "Description" is an anonymous work published in the reigns of Constantius and Constantine. (*Gen. Biog.*).

ALYPIUS, one of the seven Greek writers on music, which Meibomius hath industriously collected and published, with a commentary and explanatory notes. The time in which he flourished cannot be precisely ascertained. He is said to have wrote before Euclid & Ptolemy; and Cassiodorus arranges his work, entitled "Introduction to Music," between that of Nicomachus and Gaudentius. In this work is to be found the most complete nomenclature of all the sounds of the different scales and modes of the ancient Greek music, which have escaped the wreck of time. So complex was the science of music in Greece at this period, that the characters used for sounds were 1620 in number. The 24 letters of the alphabet furnished these notes, sometimes in an entire, sometimes in a mutilated, and sometimes in an altered form; and numerous discriminations of these took place by means of the accents and varied positions of letters.

From the MS. of Joseph Scaliger, Meursius first published this tract in 1616; but according to the testimony of Fabricius, it is by no means correct. Extracts have been published from Alypius, by Kircher, in his *Murgia*, 1650, alleging that he translated the whole into Latin; but this table of ancient musical notations is so inaccurate, which he has inserted from him, that Meibomius, who consulted not only the Greek MS. of Scaliger, but that of Bekejanus, Barocus, Barberitti, and Selden, affirms, that he found in it more than 200 errors. The learned Meibomius, with incredible industry, decyphered those characters, which previous to his time were so much confounded, disfigured, and corrupted, either through the ignorance or inattention of the transcribers of ancient MSS. This advantage resulted to the science of music, chiefly by his commentaries on Greek musicians, and particularly on the works of Alypius.

ALYPIUS of Tagasta, a Christian divine who flourished in the fourth century. In the year 388, he was baptized along with Augustine, and, in consequence of a similarity of dispositions and religious sentiments, they became strongly attached to each other. In quest of information and improvement, he took a journey into Palestine; and returning home, he soon acquired such general esteem, that he was appointed bishop of his native city. He had adopted in the early part of his life the opinions of the Manichees: but in consequence of farther information and matured experience, he became a powerful advocate for the Catholic faith. The Donatists flourished about this period, and arrogantly claimed the exclusive honour of being the true church; but he, along with his friend Augustine, united his exertions in opposing the tenets of that sect. In the council of Carthage in the year 403, the erudition and talents of Alypius, along with several other eminent divines, were unsuccessfully employed in endeavouring to reclaim them, and to bring them again into the bosom of the church. In 411 Alypius was one of the seven who held a friendly and theological conference with seven of the Donatist bishops. But all the eloquence and strength of argument made use of by these divines, although seconded by the personal degrees of the emperor Honorius, were unsuccessful in producing a recantation of their errors, or a peaceful union with their brethren. In support of the Catholic faith, Alypius appears to have vigorously exerted

Alypius
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Amadabat.

ercted his talents; and it is much to be regretted that the means he employed for that purpose were not at all times the most honourable; for in the violence of his zeal he went as deputy from the churches of Africa to the emperor Honorius, in order to obtain severe decrees against the sect of the Pelagians. Although Alypius failed in his attempts to reclaim the Donatists from error, yet he was successful with the emperor in obtaining penal decrees against the Pelagians; in consequence of which their ministers were banished, their churches demolished, and their assemblies discontinued. Alypius died about the year 430, and his dispositions appear to have participated more of the violence of zeal, than of the meekness of charity. (*Gen. Biog.*).

ALYSSUM, ALYSSON, or ALYSOIDES, *Madwort*; (from *αλυσσα*, to be mad; because it was believed to have the property of curing madness). See BOTANY Index.

ALYTARCHA, a priest of Antioch in Syria, who, in the games instituted in honour of the gods, presided over the officers who carried rods to clear away the crowd and keep order.

In the Olympic games, the alytarches had the same command, and obliged every person to preserve order and decency.

ALZIRA, a town of Spain, in the kingdom of Valencia, seated on the river Xucar. E. Long. 0. 20. N. Lat. 39. 10.

AMA, in ecclesiastical writers, denotes a vessel wherein wine, water, or the like, were held, for the service of the eucharist. In this sense the word is also written amula; sometimes also hama, and hamula.

AMA is sometimes also used for a wine measure, as a cask, pipe, or the like.

AMABYR, a barbarous custom which formerly prevailed in several parts of England and Wales, being a sum of money paid to the lord when a maid was married within his lordship. The word is old British, and signifies "the price of virginity."

AMACK. See AMAK.

AMADABAT, a corruption from AHMED ABAD, or *Ahmed's city* (so called from a king of that name); a large and populous city of Indostan, and the capital of the province of Guzerat. It is situated in E. Long. 72. 36. N. Lat. 22. 58. Amadabat was formerly called *Guzerat*; and by Shah Jehân nicknamed *Gherd-abâd*, or "the habitation of dust," because it was much incommoded therewith. It was the seat of the Guzerat kings, but belongs now to the Poonah Mahrattas. The city stands in a beautiful plain, and is watered by the little river Sabremetti, which, though not deep, in time of rains overflows the plains prodigiously. The walls are built with stone and brick, flanked at certain distances with great round towers and battlements. It has twelve gates; and, including the suburbs, is about four miles and a half long. The streets are wide. The *meydân shâh*, or king's square, is 700 paces long, and 400 broad, planted round with trees. On the west side is the castle, well walled with freestone, and as spacious as a little city; but its inward appearance is not conformable to its external magnificence. The caravansera is on the south of the square, and its chief ornament. In the midst of the city is the English fac-

Amadabat
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Amadeus.

tory, where they purchase fine chintz, calicoes, and other Indian merchandise. The place is so full of gardens stored with fruit trees, that from an eminence it looks like a wood. The Hindoos have here an hospital for sick beasts, and another for sick birds, which they take great care of. A great proportion of the itinerant musicians, players, and poets, so common throughout the province, come from this city. It was taken by the British in 1780, but restored in 1783.

AMADAN, or HAMADAN, a town of Persia, between Taurus and Ispahan. E. Long. 47. 4. N. Lat. 35. 15. It is seated at the foot of a mountain, where there are a great many springs, which water the adjacent country. The extent of the city is very large; but there are a great many waste spots within it, as well as cultivated land. The houses are built of brick hardened in the sun, and have but a very indifferent aspect. There is but one tolerable street; and that is where stuffs, garments, and the like, are exposed to sale: it is straight, long, and wide; and the shops are very well furnished. The adjacent parts are fruitful in corn and rice, insomuch that the neighbouring provinces are supplied from hence. It is said to enjoy a very salubrious air; but the cold in winter is intense. The Armenians have a church in this town; but it is a very ill contrived structure. The Jews have a synagogue near a tomb, where they pretend Esther and Mordecai lie interred. To this place they come in pilgrimage from several parts of the Levant. About a league from Amadan, there is a mountain called *Nalbana*, which abounds with all sorts of curious herbs. In the spring, people flock to this mountain from all parts to recover their health, by sucking in the salutary effluvia with their breath.

Amadan is a very ancient city. It is said to have been destroyed by Nebuchadnezzar, and rebuilt by Darius, who brought hither all his riches. The kings of Persia frequently retired to this place on account of its delightful situation; for which reason it obtained the name of the *Royal City*. It was conquered by the caliph Othman, and narrowly escaped being destroyed by Jenghiz Khan in 1220. It had then strong walls and a good castle, which are now in ruins. Its present beauty consists in its gardens and springs.

AMADANAGER, a town in the hither peninsula of India, in the province of Decan. E. Long. 74. 15. N. Lat. 18. 10. It was taken by the Moguls in 1598, after a siege of six months; being at that time defended by a strong castle, situated on an eminence, and surrounded with deep ditches, into which several springs discharged their waters.

AMADEUS V. count of Savoy, arose to that dignity in the year 1285. In him it appeared, that mental excellence can rise superior to riches or extent of territory; for although his dominions were by no means extensive, nor his riches great, yet, in consequence of his wisdom and success, he obtained the surname of *Great*. The cautious prudence of Amadeus, however, enabled him greatly to increase his territory by means of marriage, purchase, and donations. In this situation, with extended dominion, and distinguished for wisdom and prudence, he rose to such eminence among the European powers, that he was constituted their umpire to settle their differences; and in that station.

Amadeus. tion acquitted himself with much reputation and general utility. But in his character valour and wisdom were combined; for when the Turks attempted to retake the isle of Rhodes from the knights of St John of Jerusalem, he boldly defended it, and acquired great renown. A Maltese cross with the letters F. E. R. T. in future became the arms of Amadeus and his successors, in memory of this signal victory. The explanation of this motto is said to be, *Fortitudo ejus Rhodum tenuit.*—"His valour kept Rhodes." For this important service the grandmaster conferred on him the grant of a palace at Lyons. Andronicus the emperor of the east had married his daughter; and in order to promote the views of his son-in-law, Amadeus took a journey to Avignon to persuade Pope John XXII. to preach a crusade in favour of Andronicus. In the year 1323 the famous Amadeus died at that place. Deep penetration, keen discernment, consummate prudence, great valour, together with no small portion of the religious superstition of his time, appear to have been the reigning features in his character. (*Mod. Univ. Hist.*)

AMADEUS VIII. count of Savoy, in 1391, succeeded his father Amadeus VII. With the large sum of 45,000 florins of gold he purchased the country of Genevois from its last earl. Anxious to extend his territories, he purchased the city of Rumilli, upon the lake of Geneva, from the widow of the count of Genevois, and thus the house of Savoy became so illustrious that the emperor Sigismund erected Savoy into a duchy in the year 1426. Historians relate, that he assisted John Paleologus against the duke of Milan, who endeavoured to wrest from him the duchy of Montferrat. Deeply sensible of the services which he had received, Paleologus not only resigned to the duke, Chivas, Brandis, and several other estates, but submitted to hold all the marquisate of Montferrat as a fief from the house of Savoy. These fortunate acquisitions of territory were not yet limited; for upon the marriage of his daughter with Philip Maria, duke of Milan, he received Vercelli, and about the same time the count of Crescentino submitted to become his feudary. In his ambitious pursuit, he laid claim to the sovereignty of the city of Geneva; but that claim, though enforced by the pope, was rejected by the citizens with disdain, and the emperor Sigismund taking it under his protection, declared it an imperial city. After such an extensive acquisition of dominion, and amassing such sums of money, he formed the singular scheme of abandoning his throne and family; and for that purpose retired to a religious house at a place called *Ripaille*. But although he resigned the dukedom of Savoy to his eldest son Lewis, and made his youngest son Philip, count of Genevois; yet their honours were merely nominal, for he constrained them to live on a very scanty allowance, while he in his retirement received all the revenues, and collected such sums of money, that he is said to have purchased the papal honours. During the previous part of his life, having adopted great sanctity of manners, the motives for his retirement were generally reckoned religious; but what was the astonishment of mankind to behold the seat of his hermitage become the habitation of every rare delicacy, and of the most refined luxury! The local situation of the place was truly delightful, and was enriched with every thing that

could afford gratification to the senses; and his retinue consisted of some of his most intimate friends, along with 20 faithful servants, who were the guardians of his voluptuous secrets. Neither did he assume a religious habit, but wore purple robes, and upon his mantle was embroidered a golden cross. His table groaned under the weight of luxurious dainties, and the most excellent music cheered the daily feast; in short, such was the voluptuousness of that place, that in the French language the phrase, *faire ripailles*, signifies to make exquisite good cheer.

He instituted a secular knighthood in that place under the appellation of St Maurice. The brethren assumed the name of hermits, wore beards, and excluded women from their community; and in other respects composed the character of decent epicures.

When he obtained the papal dignity, and was crowned by the cardinal of Arles at Basil, all Europe was filled with astonishment in consequence of his elevation; for he had never entered into holy orders. But he had found means to remove every objection, the council confirmed his election, and with pretended reluctance he put on the pontifical ornaments, and was consecrated in the church of St Maurice. It seemed good to Amadeus to assume the title of Felix V. As might naturally be expected in such circumstances, the papal dignity was severely contested between him and Eugenius; and notwithstanding all the importunities of the council, the emperor refused to acknowledge his elevation. This religious dispute involved all Europe in contention. Historians relate that Germany remained neutral, and France, England, Italy, Spain, and Hungary, declared for Eugenius; but Arragon, Poland, and Bretagne, recognised the council only; at the same time that Savoy, Switzerland, Basil, Strasburg, Pomerania, and one of the duchies of Bavaria, recognised Felix. The emperor Frederick III. held a council at Frankfurt, before which both the popes urged their respective rights by means of deputies. This attempt, however, to regain peace to Europe was unsuccessful; therefore the emperor repaired to the vicinity of Basil, and had a personal interview with Felix. The mind of Amadeus was now so confirmed in the enjoyment of pleasure, that he had again returned to his favourite retreat; and after the fathers of the council had frequently solicited him in vain to reside at Basil, he prevailed upon them to remove to Lyons, which was near the seat of his pleasures. During the contest, Eugenius had excommunicated Felix, the council, and several of the German princes, so that the whole church was then filled with confusion and disorder. The death of Eugenius, however, terminated the struggle; for upon his death the cardinals at Rome elected Thomas de Sarzan, who assumed the name of Nicholas V. In this situation of affairs, Amadeus deemed it prudent to enter into a negotiation for the resignation of his papal crown. In this transaction he displayed the profoundest policy and address, which induced Nicholas to annul all that Eugenius had done to his dishonour, or that of his associates; to confirm the determination of the council of Basil to appoint him perpetual apostolical legate in Savoy, Piedmont, and the other places of his own dominions, and even added to these the honour of being bishop of Basil, Lausanne, Strasburg,

Amadeus.

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Amadow.

Strasburg and Constance. Nor did his vanity forsake him even in this political transaction, for he provided that he should continue to wear the pontifical dress unless in a very few particulars. In order to gratify the same haughty disposition, he stipulated that he should not be obliged to go to Rome to attend any general council; and that when he had occasion to approach the pope, he should rise to receive him, and instead of kissing his toe, he should be permitted to kiss his cheek. Amadeus retired to Lausanne, and died there at the age of 60, in the year 1451.

As the time in which he lived is fertile in memorable events, so the character of Amadeus was one of the most distinguished of his time. The versatility of his genius has led writers to differ in the delineation of his character. Some have represented him as a person of singular sanctity of manners, and possessed of uncommon moderation and virtue; others have represented him as a confirmed bigot, and a violent enthusiast; and a third class of authors have magnified his talents far above the general standard, and extolled him as one of the most accomplished princes in Europe. His real character appears to be a compound of extravagancies, in which virtue, genius, caprice, and vanity were blended. (*Mod. Univ. Hist.*).

AMADEUS IX. count of Savoy, succeeded his father Lewis, in his dominion and honours. The prince who exerts his talents to promote the happiness of his subjects, is worthy of more fame than the prince who increases the number of his subjects by unjust and unnecessary wars. In this view Amadeus IX. deserves a place in the annals of his nation. His bodily constitution was weak, and he was afflicted with the falling-sickness, yet, in consequence of his piety, virtue, benevolence, and justice, he was surnamed the *Happy*. The clemency of his temper was such that he readily pardoned those who offended him, and in few instances was he induced to punish. In his character, however, the virtue of benevolence shone with peculiar splendour among the other virtues of the Christian. A foreign minister one day used the freedom to inquire at Amadeus, if he kept any hounds. The duke replied, "a great number, and you shall see them to-morrow at noon." The minister attended at that hour in expectation of seeing a numerous pack of hounds; but the duke led him to a window which looked into an extensive square, and directing his view to a multitude of poor people eating and drinking, he exclaimed, "These are my hounds, with whom I go in chase of heaven." In all these pious and benevolent labours he was seconded by his wife Iolande of France. When one of his parsimonious courtiers reminded him that he would spend all his revenues, he generously replied, "Here is the collar of my order, let them sell it and relieve my people." In the seventh year of his reign, and the thirty-seventh of his life, he died universally lamented by all his loyal subjects, in the year 1472. In high esteem for his virtuous qualities, his subjects conferred on him the appellation of *The Blessed*. (*Mod. Univ. Hist.*).

AMADIA, a trading town of Asia, in Curdistan, belonging to the Turks; seated on a high mountain. E. Long. 43. 1. N. Lat. 36. 25.

AMADOW, a kind of black match, tinder, or touchwood, which comes from Germany. It is made
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of a sort of large mushrooms or spongy excrescences, which commonly grow on old trees, especially oaks, ash, and firs. This substance being boiled in common water, and afterwards dried and well beaten, is then put into a strong ley prepared with saltpetre, after which it is again put to dry in an oven. The druggists sell this match wholesale in France, and several hawkers retail it. Some give to the amadow the name of *pyrotechnical sponge*, because of its aptness to take fire.

AMADOWRY, a kind of cotton which comes from Alexandria by the way of Marseilles.

AMAIN, in the sea language, a term importing to lower something at once. Thus, *to strike amain*, is to lower or let fall the topsails; *to wave amain*, is to make a signal, by waving a drawn sword, or the like, as a demand that the enemy strike their topsails.

AMAK, a small island in the Baltic sea, near Copenhagen, from which it is separated by a canal over which there is a drawbridge. Amak is about four miles long and two broad; and is chiefly peopled by the descendants of a colony from East Friesland, to whom the island was consigned by Christian II. at the request of his wife Elizabeth, sister of Charles V. for the purpose of supplying her with vegetables, cheese, and butter. From the intermarriages of these colonists with the Danes, the present inhabitants are chiefly descended; but as they wear their own dress, and enjoy peculiar privileges, they appear a distinct race from the natives. The island contains about six villages, and between 3000 and 4000 souls. It has two churches, in which the ministers preach occasionally in Dutch and Danish. The inhabitants have their own inferior tribunals; but in capital offences are amenable to the king's court of justice at Copenhagen. The old national habit, brought by the original colony when they first migrated to the island, is still in use amongst them. It resembles the habit of the ancient Quakers, as represented in the pictures of the Dutch and Flemish painters. The men wear broad-brimmed hats, black jackets, full glazed breeches of the same colour, loose at the knee, and tied round the waist. The women are dressed chiefly in black jackets and petticoats, with a piece of blue glazed cloth bound on their heads. The island is laid out in gardens and pastures; and still, according to the original design, supplies Copenhagen with milk, butter, and vegetables. E. Long. 12. 35. N. Lat. 55. 30.

AMAL, a town of Sweden, in the province of Daland, seated on the river Weser. It has a good harbour, and carries on a great trade, especially in timber, deals, and tar. E. Long. 12. 40. N. Lat. 58. 50.

AMALARIC, was the son of Alaric II. and king of the Visigoths. Deprived of his father when an infant, he would have been bereft of his crown, had not his grandfather Theodoric king of the Ostrogoths interposed in his behalf. In defence of the royal infant, he expelled from the throne his natural brother, who had usurped the government, and ruled the kingdom during his life, and preserved the crown to the natural heir. In 526 the grandfather died, and Amalaric assumed the royal authority. In 517 he married Cloilda, the daughter of Clovis, an amiable lady, who inherited both the piety and orthodoxy of her mother, who was of the same name. The Catholic histo-
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Amalaric,
Amalasontha.

rians relate, that the king being violently attached to the Arian cause, used means to compel his queen to embrace the same opinions, which participated more of cruelty than piety. With all the firmness of a great mind, and the amiable patience of a Christian, she endured her wrongs for a considerable period; but at length, worn out with injurious treatment, she was forced to apply to her brothers for assistance, and sent them a handkerchief stained with her blood in proof of her cruel usage. In order to relieve their sister, one of them, Childebart king of Paris, entered the territories of Amalaric, who then resided with his court at Narbonne; and their different forces having joined battle, the troops of Amalaric were totally defeated, and the king himself forced to save his life by flying into Spain, A. D. 531. It is reported that, when endeavouring to regain Narbonne, he was slain either by an assassin, employed by Theudis his successor, or that he fell in battle. Some historians again say, that he died in Barcelona. (*Gen. Biog.*).

AMALASONTHA, youngest daughter of Theodoric the Great, king of the Ostrogoths, was born about the year 498. The sister of Clovis was her mother, and in 515, she married Eutharic the only remaining heir of the legal race of the Amali. Her father having formed the design of making him his successor, he sent to bring him from Spain for that purpose. But he never arrived at the destined honour; for Eutharic died previous to his father-in-law, and his only son Athalaric, was also bereft of his grandfather at the age of eight years. The well known abilities of Amalasontha induced Theodoric to place Athalaric, to whom he had left the kingdom of Italy, under the care of his mother. This princess inherited an ample share of her father's talents; and her father had been exceedingly careful to improve these natural endowments by means of a liberal education. She became a great proficient in the philosophy and morals of that age, and with equal elegance and grace she could converse in the Greek, Latin, and Gothic languages. Nor were her talents merely qualified to adorn private life: she displayed them in the administration of public justice, and political discussion. Her first efforts were in behalf of the injured children of Boethius and Symmachus, whom she reinstated in the possession of their inheritance. When the chiefs of the Goths were strongly inclined to treat the Romans as a conquered people, she mildly restrained their violent oppression and their ungovernable rapacity. Adorning the female character, she relieved her subjects from some of the severer impositions of her father; but carefully retained all his laws, magistrates, and political institutions. Having herself tasted of the sweets of literature, and experienced its advantages, she patronized learning with an assiduous care, by regularly paying the salaries of public teachers, and giving every encouragement to the improvement of genius. Her peaceable deportment towards the neighbouring princes forms an amiable feature in her character. Both with the imperial court, and with all the other powers, she lived upon agreeable terms, and thus universal honour and prosperity prevailed. Both in consequence of maternal affection and the high cultivation of her mind, she exerted all her ingenuity in the education of her orphan son. Unfortunately, however,

both for the mother and the son, neither the general character of the Gothic nation, nor the wayward inclinations of the boy, seconded her laudable endeavours. The Gothic nobles had just commenced their murmurings against the soft effeminate manner in which their prince was educating, when, upon a certain day, the youth having undergone some kind maternal chastisement, rushed into the room where some of the nobles were assembled, with the tears streaming from his eyes. Informed of the cause of his distress, the wrath of the nobles suddenly arose, and in a violent burst of passion they insisted upon the immediate release of their prince from the bondage of learning and from the restraints of a mother. The unfortunate youth was thus dragged from the habitation of learning, prudence, and virtue; and plunged into all the extravagancies of dissolute pleasure, and his mind inspired with contempt and aversion to his virtuous mother.

It was impossible for humanity to bear this insult and high injury without opposition; therefore, in the first effusions of her resentment she seized three of the principal persons concerned in this transaction, and confined them in one of the remotest parts of Italy. But the efforts of one or of a few individuals, are never adequate to the task of counteracting the general efforts of a nation, for the party whose sentiments were opposed to hers, grew daily in magnitude and strength, to such a degree that Amalasontha formed serious resolutions of sheltering herself under the protection of Justinian. After a correspondence had been carried on to prepare for this event, and when she was about to sail for that place, she determined to make one bold effort to regain her absolute power. With this view she caused the three persons who were in confinement to be secretly assassinated; and this action re-established her authority, although it augmented the public hatred. But another cause of disquiet soon arose. At the early age of sixteen, her son fell a victim to his debaucheries and follies, and she was left devoid of any legal claim to the crown. The accomplished and ambitious Amalasontha spurned the idea of retiring to a private station, and formed the bold design of sharing the throne with Theodotus her cousin. She had sufficient penetration to perceive that the dispositions of that youth were indolent and weak, and consequently she hoped still to remain at the helm of government. But the future fortune of that accomplished woman, demonstrates to posterity the danger of confiding in human weakness, where the principles of honour and justice and virtue are wanting. Theodotus issued an order for her confinement in an island in the lake Bolsena; and in the year 535 she was strangled in the bath. Some historians ascribe this action to the influence of the empress Theodora, who was seized with jealousy in consequence of the respect shown her by Justinian. (*Gen. Biog.*).

AMALEK, the son of Eliphaz, by Timna his concubine, and the grandson of Esau, Gen. xxxvi. 12. and 1 Chr. i. 36. Amalek succeeded Gatam in the government of Edom. He was the father of the Amalekites; a powerful people who dwelt in Arabia Petraea, between the Dead sea and the Red sea, or between Havila and Shur (1 Sam. xv. 7.); sometimes in one canton and sometimes in another. It does not appear that they

Amalasontha,
Amalek.

Amalek.

they had cities; for there is no mention of any but one in the Scriptures (*id. ib. 5.*); they lived generally in hamlets, caves, or tents.

The Israelites had scarcely passed the Red sea on their way to the wilderness, before the Amalekites came to attack them in the deserts of Rephidim (*Exod. xvii. 8. &c.*); and put those cruelly to the sword who were obliged, either through fatigue or weakness, to remain behind. Moses, by divine command, directed Joshua to fall upon this people; to record the act of inhumanity which they had committed in a book, in order to have it always before their eyes; and to revenge it in the most remarkable manner. Joshua therefore fell upon the Amalekites and defeated them, while Moses was upon the mountain, with Aaron and Hur in company. Moses, during the time of the engagement, held up his hands, to which the success of the battle was owing; for as often as he let them down, Amalek prevailed. But Moses's hands being tired, Aaron and Hur supported his arms, and held them extended while the battle lasted, which was from the morning till the approach of night, when the Amalekites were cut in pieces. This happened in the year of the world 2513, before Christ 1491.

The ground of the enmity of the Amalekites against the Israelites is generally supposed to have been an innate hatred, from the remembrance of Jacob's depriving their progenitor both of his birthright and blessing. Their falling upon them, however, and that without any provocation, when they saw them reduced to so low a condition by the fatigue of their march, and the excessive drought they laboured under, was an inhuman action, and justly deserved the defeat which Joshua gave them. Under the Judges (*v. 3.*), we see the Amalekites united with the Midianites and Moabites, in a design to oppress Israel; but Ehud delivered the Israelites from Eglon king of the Moabites (*Judg. iii.*), and Gideon (*chap. viii.*) delivered them from the Midianites and Amalekites. About the year of the world 2930, Saul marched against the Amalekites, advanced as far as their capital, and put all the people of the country to the sword; but spared the best of all the cattle and moveables, contrary to a divine command; which act of disobedience was the cause of Saul's future misfortunes.

After this war, the Amalekites scarcely appear any more in history. However, about the year of the world 2949, a troop of Amalekites came and pillaged Ziklag, which belonged to David (*1 Sam. xxx.*), where he had left his two wives, Ahinoam and Abigail; but he returning from an expedition which he had made in the company of Achish into the valley of Jezreel, pursued them, overtook and dispersed them, and recovered all the booty which they had carried off from Ziklag.

The Arabians maintain Amalek to have been the son of Ham, and grandson of Noah; that he was the father of Ad, and grandfather of Schedad. Calmet thinks that this opinion is by no means to be rejected, as it is not very probable that Amalek, the son of Eliphaz, and grandson of Esau, should be the father of a people so powerful and numerous as the Amalekites were when the Israelites departed out of Egypt. Moses in the book of Genesis (*xiv. 7.*) relates, that in Abraham's time, long before the birth of Amalek, the son

of Eliphaz, the five confederate kings carried the war into Amalek's country, about Kadesh; and into that of the Amorites, about Hazezon-tamar. The same Moses (*Num. xxiv. 20.*) relates, that the diviner Balaam, observing at a distance the land of Amalek, said in his prophetic style, "Amalek is the first, the head, the original of the nations; but his latter end shall be, that he perish for ever." Our commentator observes, that this epithet of the first of nations cannot certainly agree with the Amalekites descended from the son of Eliphaz, because the generation then living was but the third from Amalek. Besides, Moses never reproaches the Amalekites with attacking their brethren the Israelites; an aggravating circumstance, which he would not have omitted were the Amalekites descended from Esau; in which case they had been the brethren of the Israelites. Lastly, We see the Amalekites almost always joined in the Scripture with the Canaanites and Philistines, and never with the Edomites; and when Saul made war upon the Amalekites, and almost utterly destroyed them, we do not find that the Edomites made the least motion towards their assistance, nor to revenge them afterwards. Thence it is thought probable, that the Amalekites, who are so often mentioned in Scripture, were a free people descended from Canaan, and devoted to the curse as well as the other Amorites, and very different from the descendants of Amalek, the grandson of Esau.

The accounts which the Arabians give us of the Amalekites destroyed by Saul are as follow: Amalek was the father of an ancient tribe in Arabia, exterminated in the reign of Saul. This tribe contained only the Arabians who are called *Pure*; the remains whereof were mingled with the posterity of Joktan and Adnan, and so became Mosarabes or Mostaarabes; that is to say, Arabians blended with foreign nations. They further believe, that Goliath, who was overcome by David, was king of the Amalekites; and that the giants who inhabited Palestine in Joshua's time were of the same race. That at last part of the Amalekites retired into Africa while Joshua was yet living, and settled upon the coasts of Barbary, along the Mediterranean sea. The son of Amalek was Ad, a celebrated prince among the Arabians. Some make him the son of Uz, and grandson of Aram the son of Shem. Let this be as it will, the Mahometans say that Ad was the father of an Arabian tribe called *Adites*; who were exterminated, as they tell us, for not hearkening to the patriarch Eber, who preached the unity of God to them. Ad had two sons, Schedad and Schedid.

AMALFI, an ancient city of Italy, situated in E. Long. 14. 20. N. Lat. 40. 35. It is said to have derived its origin from a number of Roman families, who, about the middle of the fourth century, either from private views of emolument, or in consequence of compulsory orders from the emperor, had left Rome, and embarked for Constantinople; but meeting with storms on their passage, were cast away on the shores of Salerno, and deprived of the means of pursuing their voyage. In this state of perplexity they long remained; but at last came to the resolution of settling on the present site of Analfi, where they expected to enjoy security, and sufficient plenty of the necessaries of life. The earliest notice of them in this settlement dates no higher than the latter end of the sixth century. Im-

Amalek,
Amalfi.

Amalfi.

pervious mountains and inaccessible coasts preserved their infant state from the first fury of the Lombards, who seldom attempted the conquest of a maritime people.

In the year 825, when this little republic had, under the patronage of the eastern emperors, attained a degree of wealth and reputation sufficient to excite the ambition of its neighbours, Sico, prince of Salerno, marched a body of troops by night, surprised Amalfi, and, carrying off the greatest part of the inhabitants, compelled them to fix at Salerno, which had lately suffered a great loss of people by an epidemical disorder. But before the fourth year of their captivity was expired, the Amalfitans took advantage of the absence of the Salernitan chiefs, who were then carrying on a war with the Beneventans; armed themselves; and, after burning and plundering Salerno, marched in triumph back to their own country.

Here they framed a better system of government, and reformed many abuses in their former legislation; adopting various measures that were likely to promote internal concord, and defeat the evil intentions of foreign enemies. Their first plan was to vest the supreme authority in a temporary prefect; but the experience of a few years caused them to prefer lodging that power in the hands of a duke elected for the term of his natural life. Under these governors Amalfi attained the summit of her military and commercial glory. It extended its territory, which reached eastward from Vico Vecchio, and westward to the promontory of Minerva, including likewise the island of Caprea, and the two islands of the Galli. Towards the north, it comprehended the cities of Lettere, Gragnans, Pimontio, and Capule di Franchi; towards the south, those of Scala, Ravelli, Minori, Majuri, Atrani, Tramonti, Agerula, Citara, Prajano, and Rosilano.

Leo IV. found the Amalfitans an useful ally in his wars with the Infidels, and honoured the commonwealth with the title of *Defender of the Faith*. The Neapolitans, with whom, as Greek vassals, they were united in strict bonds of friendship, experienced many signal favours at their hands; and the Mussulmans themselves found it expedient to court their alliance, and to enter into treaty with them. Their situation had from the beginning given them a turn to commerce, and their attention to naval affairs so much consequence in the eyes of their protector, the emperor of Constantinople, that by his orders a court was established at Amalfi, for the decision of all controversies arising in maritime transactions. Its code and reports became the general rule in those cases throughout this part of Europe; its precedents and decrees were allowed to be good authority to found judgment upon even in foreign tribunals. To crown the mercantile and naval glory of the republic, it was reserved to the lot of an Amalfitan to make, or at least to perfect, the most important discovery ever made for the improvement of navigation. Pasitano, a village which stands on the shore a few miles west of Amalfi, boasts of having given birth to Flavio Gioia, the inventor of the mariner's compass.

The merchants of this town engrossed the trade of the Levant, and transacted the commercial business of the world in a lucrative and exclusive manner. The Pisans, Venetians, and Genoese, rose upon their ruin;

and, after monopolizing the emoluments of trade for some ages, made way for the more comprehensive and daring spirit of the present maritime powers.

At present Amalfi is subject to Naples, and is the see of an archbishop. It is but a shadow of what it was in its flourishing state, when it extended over the stupendous rocks that hang on each side, still crowned with battlemented walls and ruined towers. Its buildings, Mr Swinburne says, are not remarkable for elegance or size; and contain at most 4000 inhabitants, who seem to be in a poor line of life. The cathedral is an uncouth building. Under the choir is the chapel and tomb of the apostle St Andrew; to whose honour the edifice was dedicated, when Cardinal Capuano, in 1208, brought his body from Constantinople.

AMALGAM, mercury united with some metal.

AMALGAMATION, the operation of making an amalgam, or mixing mercury with any metal.

For the combination of one metal with another, it is generally sufficient that one of them be in a state of fluidity. Mercury being always fluid, is therefore capable of amalgamation with other metals without heat; nevertheless, heat considerably facilitates the operation.

To amalgamate without heat requires nothing more than rubbing the two metals together in a mortar; but the metal to be united with the mercury should be previously divided into very thin plates or grains. When heat is used (which is always most effectual, and with some metals indispensably necessary), the mercury should be heated till it begins to smoke, and the grains of metal made red hot before they are thrown into it. If it be gold or silver, it is sufficient to stir the fluid with an iron rod for a little while, and then throw it into a vessel filled with water. This amalgam is used for gilding or silvering on copper, which is afterwards exposed to a degree of heat sufficient to evaporate the mercury.

Amalgamation with lead or tin is effected by pouring an equal weight of mercury into either of these metals in a state of fusion, and stirring with an iron rod. Copper amalgamates with great difficulty, and iron not at all.

AMALTHÆA, the name of the Cumæan Sibyl, who offered to Tarquinius Superbus nine books, containing the Roman destinies, and demanded 300 pieces of gold for them. He derided her; whereupon she threw three of them into the fire; and returning, asked the same price for the other six; which being denied, she burnt three more; and returned, still demanding the same price. Upon which Tarquin consulting the pontiffs, was advised to buy them. These books were in such esteem, that two magistrates were created to consult them upon extraordinary occasions.

AMALTHÆA, in *Pagan Mythology*, the daughter of Melissus, king of Crete, and the nurse of Jupiter, whom she fed with goats milk and honey. According to others, Amalthæa was a goat, which Jupiter translated into the sky, with her two kids, and gave one of her horns to the daughters of Melissus, as a reward for the pains they had taken in attending him. This horn had the peculiar property of furnishing them with whatever they wished for; and was thence called the *cornucopia*, or horn of plenty.

AMALTHÆUS,

Amalfi

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Amalthæa.

Amalthæus
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Amand.

AMALTHÆUS, JEROME, JOHN BAPTISTA, and CORNEILLE, three celebrated Latin poets of Italy, who flourished in the 16th century. Their compositions were printed at Amsterdam in 1685. One of the prettiest pieces in that collection is an epigram on two children, whose beauty was very extraordinary, though each of them was deprived of an eye:

*Lumine Acon dextro, capta est Leonilla sinistro:
Et poterat forma vincere uterque Deos.
Parve puer, lumen quod habes concede sorori;
Sic tu cæcus Amor, sic erit illa Venus.*

AMAMA, SIXTINUS, professor of the Hebrew tongue in the university of Franeker, a man of great learning, was born in Friesland, and had studied under Drusius. He published a criticism upon the translation of the Pentateuch; collated the Dutch translation of the Bible with the original and the most accurate translations; and wrote a censure of the Vulgate translation of the historical books of the Old Testament, Job, the Psalms, and Canticles. It is impossible to answer the reasons whereby he shows the necessity of consulting the originals. This he recommended so earnestly, that some synods, being influenced by his reasons, decreed, that none should be admitted into the ministry but such as had a competent knowledge of the Hebrew and Greek text of the Scriptures. He died in 1629.

AMANCE, a town in the department of Upper Soane, upon a rivulet of the same name. E. Long. 6. 10. N. Lat. 47. 48.

AMAND, MARK ANTONY GERARD, SIEUR DE ST, a French poet, was born at Rouen in Normandy, in 1594. In the epistle dedicatory to the third part of his works, he tells us, that his father commanded a squadron of ships in the service of Elizabeth queen of England for 22 years, and that he was for three years prisoner in the Black Tower at Constantinople. He mentions also that two brothers of his had been killed in an engagement against the Turks. His own life was spent in a continual succession of travels, which was of no advantage to his fortune. There are miscellaneous poems of this author, the greatest part of which are of the comic or burlesque, and the amorous kind. Though there are many blemishes in his poems, yet he had the talent of reading them in so agreeable a manner, that every one was charmed with them. In 1650, he published *Stances sur la grossesse de la reine de Pologne et de Suede*. There are six stanzas of nine verses each. In 1653, he printed his *Moïse sauve, idyle heroïque*. This poem had at first many admirers; M. Chapelein called it a *speaking picture*; but it has since fallen into contempt. Amand wrote also a very devout piece, entitled, *Stances à M. Corneille, sur son Imitation de Jesus Christ*, which was printed at Paris in 1656. M. Brossette says, that he wrote also a poem upon the moon, wherein he paid a compliment to Lewis XIV. upon his skill in swimming, in which he used often to exercise himself when he was young, in the river Seine; but the king could not bear this poem to be read to him, which is said to have affected the author to such a degree, that he did not survive it long. He died in 1661, being 67 years of age. He was admitted a member of the French academy, when it was first founded by Cardinal Richelieu, in the year 1633;

and Mr Pelisson informs us, that in 1637, at his own desire, he was excused from the obligation of making a speech in his turn, on condition that he would compile the comic part of the dictionary which the academy had undertaken, and collect the burlesque terms. This was a task well suited to him; for it appears by his writings, that he was extremely conversant in these terms, of which he seems to have made a complete collection from the markets, and other places where the lower people resort.

AMAND, *Saint*, a city of France, in the department of Cher, formerly Bourbonnois, on the confines of Berry, seated on the river Cher. It was built in 1410, on the ruins of Orval. E. Long. 2. 30. N. Lat. 46. 40.

AMAND, *Saint*, a city of France, in the department of the North, seated on the river Scarpe. It contained by the last enumeration 8039 inhabitants. The abbot of the place is the temporal lord, and disposes of the magistracy. It was given to France by the treaty of Utrecht. E. Long. 2. 25. N. Lat. 50. 27.

AMANICÆ PYLÆ (Ptolemy); AMANIDES PYLÆ (Strabo), AMANI PORTÆ (Pliny); straits or defiles in Mount Amanus, through which Darius entered Cilicia; at a greater distance from the sea than the Pylæ Ciliciæ or Syriæ, through which Alexander passed.

AMANTEA, a sea-port town and bishop's see of the kingdom of Naples, situated near the bay of Euphemia, in the province of Calabria, in E. Long. 16. 20. N. Lat. 39. 15.

AMANUS, a mountain of Syria, separating it from Cilicia; a branch of Mount Taurus (Cicero, Strabo, Pliny); extending chiefly eastward, from the sea of Cilicia to the Euphrates: Now called *Monte Negro*, or rather *Montagna Neres*, by the inhabitants; that is, the watery mountain, as abounding in springs and rivulets.

AMAPALLA, a city and port town of North America, in the province of Guatimala, seated on the gulf of the same name, in the Pacific ocean. W. Long. 87. 55. N. Lat. 13. 12.

AMARANTE, an order of knighthood, instituted in Sweden by Queen Christina, in 1653, at the close of an annual feast, celebrated in that country, called *Wirtschaft*. This feast was solemnized with entertainments, balls, masquerades, and the like diversions, and continued from evening till the next morning.—That princess, thinking the name too vulgar, changed it into that of the *feast of the gods*, in regard each person here represented some deity as it fell to his lot. The queen assumed the name of *Amarante*; that is, unfading, or immortal. The young nobility, dressed in the habit of nymphs and shepherds, served the gods at the table. At the end of the feast, the queen threw off her habit, which was covered with diamonds, leaving it to be pulled in pieces by the masques; and in memory of so gallant a feast, founded a military order, called in Swedish *Geschiltschafft*, into which all that had been present at the feast were admitted, including 16 lords and as many ladies, besides the queen. Their device was the cypher of *Amarante*, composed of two Δ's, the one erect, the other inverted, and interwoven together; the whole enclosed by a laurel crown, with this motto, *Dolce nella memoria*.

Amand
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Amarante.

Amarante
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Amasis.

Bulstrode Whitlock, the English ambassador from Cromwell to the court of Sweden, was made a knight of the order of *Amarante*: on which account it seems to he, that we sometimes find him stiled *Sir Bulstrode Whitlock*.

AMARANTHOIDES, in *Botany*, the trivial name of a species of illecebrum. See ILLECEBRUM, BOTANY Index.

AMARANTHUS (of a privative, and *paqavva*, to wither, because the flower of this plant, when cropped, does not soon wither), AMARANTH, or FLOWER-GENTLE. See BOTANY Index.

AMARGURA, an island in the Southern Pacific ocean, discovered by Maurell in 1781. It is quite barren, and inaccessible even to boats. S. Lat. 17. 57. W. Long. 175. 17.

AMARYLLIS, LILY-ASPHODEL. See BOTANY Index.

AMARYNTHUS, in *Ancient Geography*, a hamlet of Eretrias, in the island of Eubœa, about seven stadia distant from its walls. Here Diana was worshipped in an annual solemnity, at which those of Carystus assisted; hence the title of the goddess was *Amarynthis* and *Amarysia*.

AMASIA, in *Ancient Geography*, now *Marpurg*, a city in the landgravate of Hesse, on the Lahn. According to others, it is Embden in Westphalia.

AMASIA, an ancient town of Turkey, in Natolia, remarkable for the birth of Strabo the geographer. It is the residence of a bashaw, and gives its name to the province it stands in, where there are the best wines and the best fruits in Natolia. It is seated near the river Iris or Casalmack; and was anciently the residence of the king of Cappadocia. E. Long. 36. 10. N. Lat. 39. 33.

AMASIA, the name of the northern division of Lesser Asia, lying on the south shore of the Euxine sea in Natolia. It takes its name from Amasia the capital, mentioned in the preceding article.

AMASIS, king of Egypt, ascended the throne B. C. 569, and commenced his reign with the death of his former master Apries. King Apries having sent an army to the assistance of the Libyans, which was totally routed, and great multitudes put to death, the common people conceived the idea, that the tyrannical prince had sent them to the field of battle, for no other purpose but to destroy great numbers of them, that so he might reign over the remainder with uncontrolled oppression. The consequence was, that a general insurrection arose, and all the multitude were in an uproar. Informed of this tumult, Apries sent Amasis, whom he deemed one of his most faithful adherents; but instead of endeavouring to reconcile the disaffected people to their prince, he secured them to his own interest; and while he was pretending to reproach their disloyalty, and endeavouring to recal them to duty, a soldier stepped in behind him, and placing a helmet upon his head, saluted him king of Egypt. Amasis instantly took the field against his royal master, and prepared to drive him from his throne. Apprised of the treachery of Amasis, he sent another in whom he confided, to bring Amasis before him, to give an account of his conduct. This messenger met him on horseback, and having delivered his message, Amasis, after some insolent behaviour, replied,

that he was preparing to visit the king, but thought it proper to bring a suitable equipage to attend him. When the messenger hastened back to inform his master, that he might consult for himself, his only reward was to have his ears and nose cut off, by the order of the tyrant, because he brought not Amasis along with him. In this, as in numerous other instances, tyranny procured its own destruction; for the rest of the nobles who still remained obedient to the king, seeing the barbarous manner in which he had treated the messenger, they all went over to the standard of the usurper. Now all the nation was in commotion. The usurper on the one hand, with the whole body of the natives marshalled under his banner, and the tyrant on the other hand, with a body of foreigners and mercenaries, which he had engaged in his service. The two armies met in a field in the vicinity of Memphis, and the tyrant was made captive and his forces defeated. The usurper treated the captive tyrant with great lenity and respect, and assigned him the palace of Saïs for his confinement. But the hatred of the people was too violent towards their old king, to permit him to live; Amasis was therefore forced to deliver him into their hands, and they instantly put him to death by strangling him.

The plebeian extraction of Amasis deprived him for some time of that respect, to which he was entitled as a prince; but observing this, he contrived a stratagem to induce them to pay him suitable honour. He ordered a golden cistern, in which his visitants were accustomed to wash their feet, to be melted and cast in the form of a god, and set it up in the most frequented part of the city, and all the inhabitants did it homage. He then called an assemblage of the people, and reminded them, that the gold they now venerated in the form of a god, was once a cistern, and consequently that although he was formerly a person of low rank, yet now that he was their king, they ought to give him the respect and homage due to his station.

Having by this means provided for the gratification of his vanity, he began to exert himself to act for the general good of his people. It was his constant practice to attend to business in the mornings, and in the evenings he indulged in amusement and pleasure; but in these he sometimes tarnished the dignity of a king. Indeed Amasis loved his wine and his companion so much, previous to his elevation, that it is reported that he lived by theft, and when denying upon detection, he was carried to the oracle of the place, who sometimes condemned and sometimes acquitted him. Recollecting the conduct of the oracles after he ascended the throne, he conceived a disrespect for them, because they were not able at all times to detect his robberies.

To prevent the evil consequences of an indolent populace, he enacted a law, that every person, under the penalty of a capital punishment, should appear before the governor of his respective province, and declare by what occupation he acquired his subsistence. Thus, under the prudent government of Amasis, Egypt enjoyed, for many years, great fertility and extensive population. He also employed his industry in the erection of several public works; among which were a portico to the temple of Minerva at Saïs, and the removal of a house, all of one stone, to the temple. He

also

Amasis
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Amatorii.

also built the great temple of Isis at Memphis. He likewise erected a colossus before the temple of Vulcan, 75 feet in length, resting on its back, and on the basis he erected two statues, each 20 feet high, cut out of the same stone. Besides these he raised several monuments in Greece.

The liberality and respect for science which Amasis displayed, and the encouragement he gave to learned strangers, particularly to the Greeks, to visit his country, manifested an enlightened mind. And to encourage Grecian strangers to remain in Egypt, he marked out settlements for them on the sea coast, permitted them to build temples, and to observe all the rites of their religion unmolested. Solon, the celebrated lawgiver, condescended to visit Amasis. In a short time, the fame of Amasis for his generosity and humanity was so extensive, that when the Delphians were going about from city to city, collecting sums to enable them to rebuild their consumed temple, they applied to Amasis, who gave them 1000 talents. Either to gratify the vanity, or secure the alliance of the Greeks, he married a Grecian lady, named Laodice, the daughter of Battus. But in the evening of his reign, his prosperity was greatly clouded, by the report of the vast preparations that Cambyes was making to invade Egypt. Phanes, who was captain of the Greek auxiliaries in the service of Amasis, being offended at his master, deserted his cause, and went over to Cambyes. A strong affection had long subsisted betwixt Polycrates, the tyrant of Samos, and Amasis; yet he, deserting his cause, became his enemy. Whether the forebodings of the impending storm tended to impair his health or not is not related; but about this time he died, in 525 B. C. after a reign of 44 years. It is reported that after interment, his body was dug up by his enemies, and consumed by fire, which, according to the superstition of the Egyptians, constituted a singular calamity. (*Anc. Univ. Hist.*)

AMASONIA. See BOTANY Index.

AMATHUS, a very ancient town in the south of Cyprus (Strabo, Ptolemy): so called from Amathus the founder; or, according to others, from Amath, a Phœnician town sacred to Venus, with a very ancient temple of Adonis and Venus: and hence Venus is denominated *Amathusia* (Tacitus). According to Ovid, it was a place rich in copper ore, and where the inhabitants became *Cerastæ*, or horned. Now called *Limisso*.

AMATHUS, in *Ancient Geography*, a town of the tribe of Gad, beyond Jordan; but whether at a greater or less distance from it, is not so easy to determine. Eusebius places it in the lower Peræa; Reland, in Ramoth Gilead. Gabinius, proconsul of Syria, established five juridical conventions in Judea; two of which were on the other side Jordan; one at Gadara, the other at Amathus (Josephus).

AMATIQUES, a sea-port town, in the province of Vera Paz in Mexico, at the mouth of the river Guarnacos, which flows into the gulf of Honduras. The inhabitants are chiefly employed in cutting logwood. N. Lat. 15. 23. W. Long. 89. 0.

AMATORII MUSCULI, in *Anatomy*, a term sometimes used for the obliquus superior and obliquus inferior muscles of the eye, as these muscles assist in oggling or drawing the eye sidewise.

AMATRICE, a city of the kingdom of Naples, in the farther Abruzzo, upon the confines of the pope's territories, and the marquiseate of Ancona.

AMATTA FOA, an island in the Southern Pacific ocean, which was discovered by Captain Cook in 1774. It is about five leagues in circumference, and considerably elevated; it is inhabited, but not very fertile; and it lies about twelve leagues distant, and north north-west, from Anamooka.

AMAUROSIS, in *Medicine*, a deprivation of sight, the eye remaining fair and seemingly unaffected. A perfect amaurosis is when the blindness is total; when there is still a power of distinguishing light from darkness, the disease is called by M. de St Ives an *imperfect amaurosis*. There is a periodical sort, which comes on instantaneously, continues for hours, or days, and then disappears.

AMAZIAH, one of the kings of Judah, ascended the throne of his father Joash in the 25th year of his age. His mother's name was Jehoaddan, a native of Jerusalem. In consequence of his wavering virtue, and his mingling foreign idolatry with the worship of the true God, he is said, according to Scripture, to have done that which was right in the sight of the Lord, but "not with a perfect heart." His father had been ungenerously murdered by his own servants, therefore his son, on his elevation to the throne, put to death the murderers of his father. In this act of remunerative justice, however, he showed a becoming respect to the law of Moses, which prohibited the punishing of the children for the crimes of their guilty fathers. He gave early proofs of his military talents, by making a general muster of all his subjects able to bear arms; and likewise hired a numerous army from the neighbouring kingdom of Israel; and with this increased multitude he hastened to attack Edom. The two kindred armies met together in the valley of Salt, and, after an obstinate engagement, the Edomites were put to flight; and Amaziah from thence proceeded to take the town of Selah. But the spirit of jealousy arose between the two armies, so that Amaziah thought it prudent not to make use of the arms of the Israelitish auxiliaries, consequently issued an order for their returning home; but this treatment roused the martial spirit and indignant temper of the Israelites to such a height, that, on their return, they turned their arms against the cities of Judah, and ravaged and destroyed them. The imperfection of the heart of Amaziah was fully displayed on this occasion; for he is related to have brought home the gods of the children of Seir, who were unable to protect their own votaries, and in the folly of his heart to have paid them divine honours. Flushed with the success of his arms in the valley of Salt, he sent a hostile challenge to Jehoash king of Israel, expressed in the phraseology of those times, that they should "look one another in the face. Pride goeth before destruction, and a haughty spirit before a fall." In vain the prudent and peaceful spirit of Jehoash endeavoured to persuade him from his bold attempt. They saw one another in the face at Bethshemesh, and Amaziah was made prisoner, and the men of Judah put to flight. Jehoash advanced to the capital, carrying the vanquished king along with him; and he entered the city by breaking a large portion of the wall; and, after plundering the temple and the king's

Amatrice
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Amaziah.

Amaziah, king's palace, he returned home in triumph to Samaria. This misfortune seems to have damped the military ardour of Amaziah; for, although he swayed the sceptre over Judah for many years after, yet he never engaged in any hostile contentions with his neighbours. Whether, through the oppressive conduct of Amaziah, or whatever cause, it is certain that a conspiracy was formed against him in Jerusalem, which compelled him to fly to the city of Lachish for shelter; but the confederacy was so strong and numerous, that his enemies pursued him thither; and there he fell by their hands, in the 29th year of his reign. (2 Kings xiv. 2 Chron. xxv.).

AMAZONIA, or the country of the American AMAZONS, is situated between 50 and 70 degrees of west longitude; and between 4 degrees of north, and 15 degrees of south latitude; being bounded on the south by La Plata, on the west by Peru, on the north by the province of Terra Firma, and on the east by Brazil.

With respect to the Amazons said to have given name to this territory, they have been represented as governed and led to war only by their queen. No men were suffered to live among them; though those of some neighbouring nations were suffered to visit them, at a certain season, for the sake of procreation. The females issuing from this commerce were bred up with care, and instructed in what relates to war and government; as to the males, they were sent away into the country of their fathers. But no such nation is at present to be found, any more than the giants and cannibals mentioned by the first adventurers thither.

Amazonia is generally a flat region, abounding in woods, lakes, rivers, bogs, and morasses. The chief river, and one of the largest in the world, is that called the river of Amazons, or the Orellana, which is formed by two large rivers, the one rising in the province of Quito, a little south of the equator, in 73 degrees of west longitude, and the other, named *Xauxa*, rising in the lake of Bourbon, near the Andes, in 10 degrees of south latitude. These two rivers uniting on the confines of Peru and Amazonia, in three degrees odd minutes of south latitude, assume the name of Amazon; whence running eastward upwards of 2000 miles, and afterwards inclining to the north, they fall into the Atlantic ocean by 84 channels, which in the rainy season overflow the adjacent country. Besides the two streams mentioned, a multitude of others, both on the north and south side, contribute to the formation of this extraordinary river. As it runs almost across the broadest part of South America, it is computed to be between 4000 and 5000 miles in length, including all its windings. Its channel from Junta de los Reyes, to the river Maragnon, is from one to two leagues broad; it then widens from three to four, and becomes gradually broader as it approaches the ocean. Between the places last mentioned, its depth is from five to ten fathoms; but from Maragnon to Rio Negro it increases to 20 fathoms; after which it is sometimes 30, and sometimes 50 fathoms, or more, till it comes near the end of its course. Its course is very rapid, and the numerous islands in its channel often change their place during the floods. The manatu and tortoise abound both upon the banks of this and the other rivers; and the fishermen must be upon their guard against the

crocodiles, alligators, and water serpents, which also swarm here.

The air, as in the countries under the same parallel, is observed to be nearly as cool under the equator as about the tropics, on account of the rains continuing longer, and the sky in that season being clouded; but the climate is moist and unhealthy. An easterly wind sets from the Atlantic up the river so strong, that vessels are carried by it against the stream.

The produce of the country is Indian corn and the cassava root, of which they make flour and bread; tobacco, cotton, sugar, sarsaparilla, yams, potatoes, and other roots. They have also plenty of venison, fish, and fowl. Among the latter are vast flocks of parrots of all colours, the flesh of which serves for food and the feathers for ornament. All the trees here are evergreens; and fruits, flowers, and herbage, are in perfection all the year round. The principal fruits are cocoa nuts, ananas or pine apples, guavas, bananas, and such others as are usually found between the tropics. The forest and timber trees are cedar, Brazil wood, oak, ebony, logwood, ironwood, so called from its weight and hardness, and several sorts of dyeing wood.

The natives are of the common stature, with good features, a copper complexion, black eyes and hair. It is computed that there are of them about 150 different tribes or nations, and the villages are so numerous as to be within call of one another. Among those the Homagues, a people near the head of the river, are famous for their cotton manufactures; the Jurines, who live between five and ten degrees of latitude, for their joiners work; and the Wrosissares for their earthen ware. The Topinambes, who inhabit a large island in the river, are remarkable for their strength. Some of those nations frequently make war upon each other. Their armour consists of darts, javelins, bows and arrows; and they wear targets of cane or fish-skin. They make slaves of their prisoners, whom they otherwise use very well. Every tribe is governed by its respective chief or king, the marks of whose dignity are a crown of parrots feathers, a chain of lions teeth or claws hung round his neck, or girt about his waist, and a wooden sword which he carries in his hand.

Most of those nations, except the Homagues, go naked. The women thrust pieces of cane through their ears and under lips, as well as through the skin of the pudenda. At the gistle of their noses they also hang glass beads, which wag to and fro when they speak. They are such skilful marksmen, that they will shoot fish as they swim; and what they catch they eat without either bread or salt. They worship images, which they always carry with them on their expeditions; but they neither have temples nor any order of priests; and permit both polygamy and concubinage.

The country affords neither gold nor silver mines; only a small quantity of the former is found in the rivulets which fall into the Amazon near its sources in Peru. When the Spaniards imagined that it contained those metals, they made great efforts from Peru to reduce this territory to subjection; till being at length undeceived, they abandoned the design.

AMAZONS, in antiquity, a nation of female warriors, who founded an empire in Asia Minor, upon the river Thermoodon, along the coasts of the Black sea. They

Amazonia,
Amazons.

Amazons.

They are said to have formed a state, out of which men were excluded. What commerce they had with that sex, was only with strangers; they killed all their male children; and they cut off the right breasts of their females, to make them more fit for the combat. From which last circumstance it is that they are supposed to take their name, viz. from the privative α , and $\mu\alpha\sigma\tau\omicron\varsigma$, *mamma*, "breast." But Dr Bryant, in his *Analysis of Ancient Mythology*, explodes this account as fabulous; and observes that they were in general Cuthite colonies from Egypt and Syria, who formed settlements in different countries, and that they derived their name from $\sigma\omicron\nu$, "the sun," which was the national object of worship, vol. iii. p. 463. It has indeed been controverted, even among ancient writers, whether there ever really was such a nation as that of the Amazons. Strabo, Palæphatus, and others, deny it. On the contrary, Herodotus, Pausanias, Diodorus Siculus, Trogus Pompeius, Justin, Pliny, Mela, Plutarch, &c. expressly assert it.

M. Petit, a French physician, published a Latin dissertation in 1685, to prove that there was really a nation of Amazons. It contains abundance of curious inquiries relating to their habit, their arms, the cities built by them, &c. Others of the moderns also maintain, that their existence is sufficiently proved by the testimony of such of the historians of antiquity as are most worthy of credit; by the monuments which many of them have mentioned; and by medals, some of which are still remaining; and that there is not the least room to believe that what is said of them is fabulous.

The Amazons are mentioned by the most ancient of the Greek writers. In the third book of the *Iliad*, Homer represents Priam speaking of himself as having been present in the earlier part of his life, in a battle with the Amazons; and some of them afterwards came to the assistance of that prince during the siege of Troy.

The Amazons are particularly mentioned by Herodotus. That historian informs us that the Grecians fought a battle with the Amazons on the river Thermodoon, and defeated them. After this victory, they carried off all the Amazons they could take alive in three ships. But whilst they were out at sea, these Amazons conspired against the men, and killed them all. Having, however, no knowledge of navigation, nor any skill in the use of the rudder, sails, or oars, they were driven by wind and tide till they arrived at the precipices of the lake Mæotis, in the territories of the Scythians. Here the Amazons went ashore, and, marching into the country, seized and mounted the first horses they met with, and began to plunder the inhabitants. The Scythians at first conceived them to be men; but after they had had skirmishes with them, and taken some prisoners, they discovered them to be women. They were then unwilling to carry on hostilities against them; and by degrees a number of the young Scythians formed connexions with them, and were desirous that these gentle dames should live with them as wives, and be incorporated with the rest of the Scythians. The Amazons agreed to continue their connexion with their Scythian husbands, but refused to associate with the rest of the inhabitants of the country, and especially with the women of it. They afterwards

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prevailed upon their husbands to retire to Sarmatia, where they settled. "Hence," says Herodotus, "the wives of the Sarmatians still continue their ancient way of living. They hunt on horseback in the company of their husbands, and sometimes alone. They march with their armies, and wear the same dress with the men. The Sarmatians use the Scythian language, but corrupted from the beginning, because the Amazons never learned to speak correctly. Their marriages are attended with this circumstance; no virgin is permitted to marry till she has killed an enemy in the field; so that some always grow old before they can qualify themselves as the law requires."

Diodorus Siculus says, "There was formerly a nation who dwelt near the river Thermodoon, which was subjected to the government of women, and in which the women, like men, managed all the military affairs. Among these female warriors, it was said, was one who excelled the rest in strength and valour. She assembled together an army of women, whom she trained up in military discipline, and subdued some of the neighbouring nations. Afterwards, having by her valour increased her fame, she led her army against the rest; and being successful, she was so puffed up, that she styled herself the daughter of Mars, and ordered the men to spin wool, and do the work of the women within doors. She also made laws, by which the women were enjoined to go to the wars, and the men to be kept at home in a servile state, and employed in the meanest offices. They also debilitated the arms and thighs of those male children who were born of them, that they might be thereby rendered unfit for war. They seared the right breasts of their girls, that they might be no interruption to them in fighting: whence they derived the name of Amazons. Their queen, having become extremely eminent for skill and knowledge in military affairs, at length built a large city at the mouth of the river Thermodoon, and adorned it with a magnificent palace. In her enterprises she adhered strictly to military discipline and good order; and she added to her empire all the adjoining nations, even to the river Tanais. Having performed these exploits, she at last ended her days like a hero, falling in a battle, in which she had fought courageously. She was succeeded in the kingdom by her daughter, who imitated the valour of her mother, and in some exploits excelled her. She caused the girls from their very infancy to be exercised in hunting, and to be daily trained up in military exercises. She instituted solemn festivals and sacrifices to Mars and Diana, which were named Tauropoli. She afterwards carried her arms beyond the river Tanais, and subdued all the people of those regions, even unto Thrace. Returning then with a great quantity of spoils into her own kingdom, she caused magnificent temples to be erected to the deities before mentioned; and she gained the love of her subjects by her mild and gentle government. She afterwards undertook an expedition against those who were on the other side of the river, and subjected to her dominion a great part of Asia, extending her arms as far as Syria."

Diodorus also mentions another race of Amazons who dwelt in Africa; and whom he speaks of as being of greater antiquity than those who lived near the river Thermodoon. "In the western parts of Libya,"

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says

Amazons. says he, "upon the borders of those tracts that are habitable, there was anciently a nation under the government of women, and whose manners and mode of living were altogether different from ours. It was the custom of those women to manage all military affairs; and for a certain time, during which they preserved their virginity, they went out as soldiers into the field. After some years employed in this manner, when the time appointed for this purpose was expired, they associated themselves with men, in order to obtain children. But the magistracy, and all public offices, they kept entirely in their own hands. The men, as the women are with us, were employed in household affairs, submitting themselves wholly to the authority of their wives. They were not permitted to take any part in military affairs, or to have any command, or any public authority, which might have any tendency to encourage them to cast off the yoke of their wives. As soon as any child was born, it was delivered to the father, to be fed with milk, or such other food as was suitable to its age. If females were born, they seared their breasts, that they might not be burdensome to them when they grew up; for they considered them as great hinderances in fighting.

Justin represents the Amazonian republic to have taken its rise in Scythia. The Scythians had a great part of Asia under their dominion upwards of 400 years, till they were conquered by Ninus, the founder of the Assyrian empire. After his death, which happened about 1150 years before the Christian era, and that of Semiramis and their son Ninyas, Ilinus and Scelopites, princes of the royal blood of Scythia, were driven from their country by other princes, who like them aspired to the crown. They departed with their wives, children, and friends; and being followed by a great number of young people of both sexes, they passed into Asiatic Sarmatia, beyond Mount Camassus, where they formed an establishment, supplying themselves with the riches they wanted, by making incursions into the countries bordering on the Euxine sea. The people of those countries, exasperated by the incursions of their new neighbours, united, surprised, and massacred the men.

The women then resolving to revenge their death, and at the same time to provide for their own security, resolved to form a new kind of government, to choose a queen, enact laws, and maintain themselves, without men, even against the men themselves. This design was not so very surprising as at first sight appears: for the greatest number of the girls among the Scythians had been inured to the same exercises as the boys; to draw the bow, to throw the javelin, to manage other arms; to riding, hunting, and even the painful labours that seem reserved for men; and many of them, among the Sarmatians, accompanied the men in war. Hence they had no sooner formed their resolution, than they prepared to execute it, and exercised themselves in all military operations. They soon secured the peaceable possession of the country; and not content with showing their neighbours that all their efforts to drive them thence or subdue them were ineffectual, they made war upon them, and extended their own frontiers. They had hitherto made use of the instructions and assistance of a few men that remained in the country; but finding at length that they could stand their ground

and aggrandize themselves, without them, they killed all those whom flight or chance had saved from the fury of the Sarmatians, and for ever renounced marriage, which they now considered as an insupportable slavery. But as they could only secure the duration of their new kingdom by propagation, they made a law to go every year to the frontiers, to invite the men to come to them; to deliver themselves up to their embraces, without choice on their part, or the least attachment; and to leave them as soon as they were pregnant. All those whom age rendered fit for propagation, and were willing to serve the state by breeding girls, did not go at the same time in search of men: for in order to obtain a right to promote the multiplication of the species, they must first have contributed to its destruction; nor was any thought worthy of giving birth to children till she had killed three men.

If from this commerce they brought forth girls, they educated them; but with respect to the boys, if we may believe Justin, they strangled them at the moment of their birth: according to Diodorus Siculus, they twisted their legs and arms, so as to render them unfit for military exercises; but Quintus Curtius, Philostratus, and Jordanus, say, that the less savage sent them to their fathers. It is probable, that at first, when their fury against the men was carried to the greatest height, they killed the boys; that when this fury abated, and most of the mothers were filled with horror at depriving the little creatures of the lives they had just received from them, they fulfilled the first duties of a mother; but to prevent their causing a revolution in the state, maimed them in such a manner as to render them incapable of war, and employed them in the mean offices which these warlike women thought beneath them. In short, that when their conquests had confirmed their power, their ferocity subsiding, they entered into political engagements with their neighbours; and the number of the males they had preserved becoming burdensome, they, at the desire of those who rendered them pregnant, sent them the boys, and continued still to keep the girls.

As soon as the age of the girls permitted, they took away the right breast, that they might draw the bow with the greater force. The common opinion is, that they burnt that breast, by applying to it, at eight years of age, a hot brazen instrument, which insensibly dried up the fibres and glands: some think that they did not make use of so much ceremony, but that when the part was formed, they got rid of it by amputation: some again, with much greater probability, assert that they employed no violent measures; but, by a continual compression of that part from infancy, prevented its growth, at least so far as to hinder its ever being incommodious in war.

Plutarch, treating of the Amazons in his life of Theseus, considers the accounts which had been preserved concerning them as partly fabulous, and partly true. He gives some account of a battle which had been fought between the Athenians and the Amazons at Athens; and he relates some particulars of this battle which had been recorded by an ancient writer named Clidemus. He says, "That the left wing of the Amazons moved towards the place which is yet called Amazonium, and the right to a place called Pryx, near Chrysa; upon which the Athenians, issuing from behind

Amazons.

Amazons.

hind the temple of the Muses, fell upon them; and that this is true, the graves of those that were slain, to be seen in the streets that lead to the gate Piraica, by the temple of the hero Chalcodue, are a sufficient proof. And here it was that the Athenians were routed, and shamefully turned their backs to women, as far as to the temple of the Furies. But fresh supplies coming in from Palladium, Ardetus, and Lyceum, charged their right wing, and beat them back into their very tents; in which action a great number of the Amazons were slain." In another place he says, "It appears that the passage of the Amazons through Thessaly was not without opposition; for there are yet to be seen many of their sepulchres near Scotussæa and Cynocephalæ." And in his life of Pompey, speaking of the Amazons, Plutarch says, "They inhabit those parts of Mount Caucasus that look towards the Hyrcanian sea (not bordering upon the Albanians, for the territories of the Getæ and the Lesgæ lie betwixt): and with these people do they yearly, for two months only, accompany and cohabit, bed and board, near the river Thermoodon. After that they retire to their own habitations, and live alone all the rest of the year."

Quintus Curtius says, "The nation of the Amazons is situated upon the borders of Hyrcania, inhabiting the plains of Thermiscyra, near the river Thermoodon. Their queen was named Thalestris, and she had under her subjection all the country that lies between Mount Caucasus and the river Phasis. This queen came out of her dominions, in consequence of an ardent desire she had conceived to see Alexander; and being advanced near the place where he was, she previously sent messengers to acquaint him, that the queen was come to have the satisfaction of seeing and conversing with him. Having obtained permission to visit him, she advanced with 300 of her Amazons, leaving the rest of her troops behind. As soon as she came within sight of the king, she leaped from her horse, holding two javelins in her right hand. The apparel of the Amazons does not cover all the body, for their left side is naked down to the stomach; nor do the skirts of their garments, which they tie up in a knot, reach below their knees. They preserve their left breast entire, that they may be able to suckle their female offspring; and they cut off and sear their right, that they may draw their bows, and cast their darts, with the greater ease. Thalestris looked at the king with an undaunted countenance, and narrowly examined his person; which did not, according to her ideas, come up to the fame of his great exploits: For the barbarians have a great veneration for a majestic person, esteeming those only to be capable of performing great actions on whom nature has conferred a dignified appearance. The king having asked her whether she had any thing to desire of him, she replied, without scruple or hesitation, that she was come with a view to have children by him, she being worthy to bring him heirs to his dominions. Their offspring, if of the female sex, she would retain herself; and if of the male sex, it should be delivered to Alexander. He then asked her, whether she would accompany him in his wars? But this she declined, alleging, That she had left nobody to take care of her kingdom. She continued to solicit Alexander, that he would not send her back without conforming to

her wishes; but it was not till after a delay of 13 days that he complied. She then returned to her own kingdom." Amazons.

Justin also repeatedly mentions this visit of Thalestris to Alexander; and in one place he says, that she made a march of 25 days, in order to obtain this meeting with him. The interview between Alexander and Thalestris is likewise mentioned by Diodorus Siculus. The learned Goropius, as he is quoted by Dr Petit, laments, in very pathetic terms, the hard fate of Thalestris, who was obliged to travel so many miles, and to encounter many hardships, in order to procure this interview with the Macedonian prince; and, from the circumstances, is led to consider the whole account as incredible. But Dr Petit, with equal erudition, with equal eloquence, and with superior force of reasoning, at length determines, that her journey was not founded upon irrational principles, and that full credit is due to those grave and venerable historians by whom this transaction has been recorded.

The Amazons are represented as being armed with bows and arrows, with javelins, and also with an axe of a particular construction, which was denominated the axe of the Amazons. According to the elder Pliny, this axe was invented by Penthesilea, one of their queens. On many ancient medals are representations of the Amazons, armed with these axes. They are also said to have had bucklers in the shape of a half moon.

The Amazons are mentioned by many other ancient authors, besides those which have been enumerated; and if any credit be due to the accounts concerning them, they subsisted through several ages. They are represented as having rendered themselves extremely formidable; as having founded cities, enlarged the boundaries of their dominions, and conquered several other nations.

That at any period there should have been women, who, without the assistance of men, built cities and governed them, raised armies and commanded them, administered public affairs, and extended their dominion by arms, is undoubtedly so contrary to all that we have seen and known of human affairs, as to appear in a very great degree incredible; but that women may have existed sufficiently robust, and sufficiently courageous, to have engaged in warlike enterprises, and even to have been successful in them, is certainly not impossible, however contrary to the usual course of things. In support of this side of the question, it may be urged, that women who have been early trained to warlike exercises, to hunting, and to a hard and laborious mode of living, may be rendered more strong, and capable of more vigorous exertions, than men who have led indolent, delicate, and luxurious lives, and who have seldom been exposed even to the inclemencies of the weather. The limbs of women, as well as of men, are strengthened and rendered more robust by frequent and laborious exercise. A nation of women, therefore, brought up and disciplined as the ancient Amazons are represented to have been, would be superior to an equal number of effeminate men, though they might be much inferior to any equal number of hardy men, trained up and disciplined in the same manner.

That much of what is said of the Amazons is fabulous, there can be no reasonable doubt; but it does not

Amazons therefore follow, that the whole is without foundation. The ancient medals and monuments on which they are represented are very numerous, as are also the testimonies of ancient writers. It seems not rational to suppose that all this originated in fiction, though it be much blended with it. The abbé Guyon speaks of the history of the Amazons as having been regarded by many persons as fabulous, "rather from prejudice than from any real and solid examination;" and it must be acknowledged, that the arguments in favour of their existence, from ancient history, and from ancient monuments, are extremely powerful. The fact seems to be, that truth and fiction have been blended in the narrations concerning these ancient heroines.

Instances of heroism in women have occasionally occurred in modern times, somewhat resembling that of the ancient Amazons. The times and the manners of chivalry, in particular, by bringing great enterprises, bold adventurers, and extravagant heroism, into fashion, inspired the women with the same taste. The women, in consequence of the prevailing passion, were now seen in the middle of camps and of armies. They quitted the soft and tender inclinations, and the delicate offices of their own sex, for the toils and the toilsome occupations of ours. During the crusades, animated by the double enthusiasm of religion and of valour, they often performed the most romantic exploits; obtained indulgencies on the field of battle, and died with arms in their hands, by the side of their lovers or of their husbands.

In Europe, the women attacked and defended fortifications; princesses commanded their armies, and obtained victories. Such was the celebrated Joan de Montfort, disputing for her duchy of Bretagne, and fighting herself. Such was that still more celebrated Margaret of Anjou, that active and intrepid general and soldier, whose genius supported a long time a feeble husband; which taught him to conquer; which replaced him upon the throne; which twice relieved him from prison; and, oppressed by fortune and by rebels, which did not bend till after she had decided in person twelve battles.

The warlike spirit among the women, consistent with ages of barbarism, when every thing is impetuous because nothing is fixed, and when all excess is the excess of force, continued in Europe upwards of 400 years, showing itself from time to time, and always in the middle of convulsions, or on the eve of great revolutions. But there were eras and countries in which that spirit appeared with particular lustre. Such were the displays it made in the 15th and 16th centuries in Hungary, and in the islands of the Archipelago and the Mediterranean, when they were invaded by the Turks.

Among the striking instances of Amazonian conduct in modern ladies, may be mentioned that of Jane of Belleville, widow of Mons. de Clisson, who was beheaded at Paris, in the year 1343, on a suspicion of carrying on a correspondence with England and the count de Montfort. This lady, filled with grief for the death of her late husband, and exasperated at the ill treatment which she considered him as having received, sent off "her son secretly to London; and when her apprehensions were removed with respect to him, she sold her jewels, fitted out three ships, and put to sea, to

Amazons. revenge the death of her husband upon all the French with whom she should meet. This new corsair made several descents upon Normandy, where she stormed castles; and the inhabitants of that province were spectators more than once, whilst their villages were all in a blaze, of one of the finest women in Europe, with a sword in one hand and a torch in the other, urging the carnage, and eyeing with pleasure all the horrors of war."

We read in Mezeray (under the article of the Croisade, preached by St Bernard in the year 1147), "That many women did not content themselves with taking the cross, but that they also took up arms to defend it, and composed squadrons of females, which rendered credible all that has been said of the prowess of the Amazons."

In the year 1590, the League party obtained some troops from the king of Spain. Upon the news of their being disembarked, Barri de St Aunez, Henry IV.'s governor at Lencate, set out to communicate a scheme to the duke de Montmorenci, commander in that province. He was taken in his way by some of the troops of the League, who were also upon their march with the Spaniards towards Leucatc. They were persuaded, that by thus having the governor in their hands, the gates of that place would be immediately opened to them, or at least would not hold out long. But Constantia de Cecelli, his wife, after having assembled the garrison, put herself so resolutely at their head, pike in hand, that she inspired the weakest with courage; and the besiegers were repulsed wherever they presented themselves. Shame, and their great loss, having rendered them desperate, they sent a messenger to this courageous woman, acquainting her, that if she continued to defend herself, they would hang her husband. She replied, with tears in her eyes, "I have riches in abundance: I have offered them, and I do still offer them, for his ransom; but I would not ignominiously purchase a life which he would reproach me with, and which he would be ashamed to enjoy. I will not dishonour him by treason against my king and country." The besiegers having made a fresh attack without success, put her husband to death, and raised the siege. Henry IV. afterwards sent to this lady the hrevet of governess of Leucatc, with the reversion for her son.

The famous maid of Orleans, also, is an example known to every reader.

The Abbé Arnaud, in his memoirs, speaks of a countess of St Balmont, who used to take the field with her husband, and fight by his side. She sent several Spanish prisoners of her taking to Marshal Feuquières; and, what was not a little extraordinary, this Amazon at home was all affability and sweetness, and gave herself up to readings and acts of piety.

Dr Johnson seems to have given some credit to the accounts which have been transmitted down to us concerning the ancient Amazons; and he has endeavoured to show, that we ought not hastily to reject ancient historical narrations because they contain facts repugnant to modern manners, and exhibit scenes to which nothing now occurring bears a resemblance. "Of what we know not (says he) we can only judge by what we know. Every novelty appears more wonderful, as it is more remote from any thing with which experience

Amazons, experience or testimony have hitherto acquainted us; and, if it passes farther beyond the notions that we have been accustomed to form, it becomes at last incredible. We seldom consider that human knowledge is very narrow; that national manners are formed by chance; that uncommon conjunctures of causes produce rare effects; or, that what is impossible at one time or place may yet happen in another. It is always easier to deny than to inquire. To refuse credit confers for a moment an appearance of superiority which every little mind is tempted to assume, when it may be gained so cheaply as by withdrawing attention from evidence, and declining the fatigue of comparing probabilities. Many relations of travellers have been slighted as fabulous, till more frequent voyages have confirmed their veracity; and it may reasonably be imagined that many ancient historians are unjustly suspected of falsehood, because our own times afford nothing that resembles what they tell. Few narratives will, either to men or women, appear more incredible than the histories of the Amazons; of female nations, of whose constitution it was the essential and fundamental law, to exclude men from all participation, either of public affairs or domestic business; where female armies marched under female captains, female farmers gathered the harvest, female partners danced together, and female wits diverted one another. Yet several sages of antiquity have transmitted accounts of the Amazons of Caucasus; and of the Amazons of America, who have given their name to the greatest river in the world, Condamine lately found such memorials as can be expected among erratic and unlettered nations, where events are recorded only by tradition, and new swarms settling in the country from time to time confuse and efface all traces of former times."

No author has taken so much pains upon this subject as Dr Petit. But, in the course of his work, he has given it as his opinion, that there is great difficulty in governing the women even at present, though they are unarmed and unpractised in the art of war. After all his elaborate inquiries and discussions, therefore, this learned writer might probably think, that it is not an evil of the first magnitude that the race of Amazons now ceases to exist.

Rousseau says, "The empire of the woman is an empire of softness, of address, of complacency. Her commands are caresses, her menaces are tears." But the empire of the Amazons was certainly an empire of a very different kind. Upon the whole, we may conclude with Dr Johnson: "The character of the ancient Amazons was rather terrible than lovely. The hand could not be very delicate that was only employed in drawing the bow, and brandishing the battle-axe. Their power was maintained by cruelty, their courage was deformed by ferocity; and their example only shows, that men and women live best together."

AMAZONS, *the river of*, in America. See AMAZONIA.

AMAZONIAN Habit, in antiquity, denotes a dress formed in imitation of the Amazons. Marcia the famous concubine of the emperor Commodus, had the appellation of *Amazonian*, because she charmed him most in a habit of this kind. Hence also that prince himself engaged in combat in the amphitheatre in an *Amazonian habit*; and of all titles the *Amazonius* was

one of those he most delighted in. In honour either of the gallant or his mistress, the month December was also denominated *Amazonius*. Some also apply *Amazonian* habit to the hunting-dress worn by many ladies among us.

AMBA, an Abyssinian or Ethiopic word, signifying a *rock*. The Abyssinians give names to each of their rocks, as *Amba-Dorho*, the rock of a hen, &c. Some of these rocks are said to have the name of *Aorini*; and are of such a stupendous height, that the Alps and Pyrenees are but low hills in comparison of them. Amongst the mountains, and even frequently in the plains, of this country, arise steep and craggy rocks of various forms, some resembling towers, others pyramids, &c. so perpendicular and smooth on the sides, that they seem to be works of art; insomuch, that men, cattle, &c. are craned up by the help of ladders and ropes: and yet the tops of these rocks are covered with woods, meadows, fountains, fish-ponds, &c. which very copiously supply the animals seated thereon with all the conveniences of life. The most remarkable of these rocks is called *Amba-Geshen*. It is prodigiously steep, in the form of a castle built of freestone, and almost impregnable. Its summit is about half a Portuguese league in breadth, and the circumference at the bottom about half a day's journey. The ascent at first is easy; but grows afterwards so steep, that the Abassine oxen, which will otherwise clamber like goats, must be craned up, and let down with ropes. Here the princes of the blood were formerly confined, in low cottages amongst shrubs and wild cedars, with an allowance barely sufficient to keep them alive. There is, according to Kircher, in this country, a rock so curiously hollowed by nature, that at a distance it resembles a looking-glass; and opposite to this another, on the top of which nothing can be so softly whispered but it may be heard a great way off. Between many of these rocks and mountains are vast abysses, which appear very dreadful to the eye.

AMBACHT, is a word which denotes a kind of jurisdiction or territory, the possessor whereof has the administration of justice, both in *alto* and *basso*; or of what is called, in the Scots law, *a power of pit and gallows*, i. e. a power of drowning and hanging. In some ancient writers, *ambacht* is particularly used for the jurisdiction, government, or chief magistracy of a city. The word is very ancient, though used originally in a sense somewhat different. Ennius calls a mercenary, or slave hired for money, *ambactus*; and Cæsar gives the same appellation to a kind of dependents among the Gauls, who, without being slaves, were attached to the service of great lords.

AMBAGES. See CIRCUMLOCUTION.

AMBARVALIA, in antiquity, a ceremony among the Romans, when, in order to procure from the gods a happy harvest, they conducted the victims thrice round the corn fields in procession, before sacrificing them.—*Ambarvalia* were either of a private or public nature: the private were performed by the master of a family, and the public by the priests who officiated at the solemnity, called *fratres arvales*. The prayer preferred on this occasion, the formula of which we have in *Cato de Re Rustica*, cap. cxlii. was called *carmen ambarvale*. At these feasts they sacrificed to Ceres a sow, a sheep, and a bull or heifer, whence they took the

Amazonian
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Ambarvalia.

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Amber.

Amber.

the name of *suovetaurilia*. The method of celebrating them was, to lead a victim round the fields, while the peasants accompanied it, and one of their number, crowned with oak, hymned forth the praises of Ceres, in verses composed on purpose. This festival was celebrated twice a-year; at the end of January, according to some, or in April, according to others; and for the second time, in the month of July.

AMBASSADOR, or **EMBASSADOR**, a public minister sent from one sovereign prince, as a representative of his person, to another.

Ambassadors are either ordinary or extraordinary. Ambassador *in ordinary*, is he who constantly resides in the court of another prince, to maintain a good understanding, and look to the interest of his master. Till about two hundred years ago, ambassadors in ordinary were not heard of: all, till then, were ambassadors *extraordinary*; that is, such as are sent on some particular occasion, and who retire as soon as the affair is despatched.

By the law of nations, none under the quality of a sovereign prince can send or receive an ambassador. At Athens, ambassadors mounted the pulpit of the public orators, and there opened their commission, acquainting the people with their errand. At Rome, they were introduced to the senate, and delivered their commissions to the fathers.

Ambassadors should never attend any public solemnities, as marriages, funerals, &c. unless their masters have some interest therein: nor must they go into mourning on any occasions of their own, because they represent the person of their prince. By the civil law, the moveable goods of an ambassador, which are accounted an accession to his person, cannot be seized on, neither as a pledge nor for payment of a debt, nor by order or execution of judgment, nor by the king's or state's leave where he resides, as some conceive: for all actions ought to be far from an ambassador, as well that which toucheth his necessities, as his person: if therefore, he hath contracted any debt, he is to be called upon kindly; and if he refuses, then letters of request are to go to his master. Nor can any of the ambassador's domestic servants that are registered in the secretary of state's office be arrested in person or goods; if they are, the process shall be void, and the parties suing out and executing it shall suffer and be liable to such penalties and corporal punishment as the lord chancellor or either of the chief justices shall think fit to inflict. Yet ambassadors cannot be defended when they commit any thing against that state, or the person of the prince, with whom they reside; and if they are guilty of treason, felony, &c. or any other crime against the law of nations, they lose the privilege of an ambassador, and may be subject to punishment as private aliens.

AMBE, in *Surgery*, the name of an instrument for reducing dislocated bones. In *Anatomy*, a term for the superficial jutting out of a bone.

AMBER (*Succinum*), in *Natural History*, a solid, hard, semipellucid, bituminous substance, of a particular nature, of use in medicine and in several of the arts. It has been called *ambra* by the Arabians, and *electrum* by the Greeks.

Amber has been of great repute in the world from the earliest times. Many years before Christ it was in

esteem as a medicine; and Plato, Aristotle, Herodotus, Æschylus, and others, have commended its virtues. In the times of the Romans, it became in high esteem as a gem; and in the luxurious reign of Nero, immense quantities of it were brought to Rome, and used for ornamenting works of various kinds.

The most remarkable property of this substance is, that when rubbed it draws or attracts other bodies to it: and this, it is observed, it does even to those substances which the ancients thought it had an antipathy to; as oily bodies, drops of water, human sweat, &c. Add, that, by the friction it is brought to yield light pretty copiously in the dark; whence it is reckoned among the native phosphori.

The property which amber possesses of attracting light bodies was very anciently observed. Thales of Miletus, 600 years before Christ, concluded from hence, that it was animated. But the first person who expressly mentions this substance is Theophrastus, about the year 300 before Christ. The attractive property of amber is likewise occasionally taken notice of by Pliny and other later naturalists, particularly by Gassendus, Kenelm Digby, and Sir Thomas Brown; but it was generally apprehended that this quality was peculiar to amber and jet, and perhaps agate, till Gilbert published his treatise *de Magnete*, in the year 1600. From *ιληκτρον*, the Greek name for amber, is derived the term *Electricity*, which is now very extensively applied, not only to the power of attracting light bodies inherent in amber, but to other similar powers, and their various effects in whatever bodies they reside, or to whatever bodies they may be communicated.

Amber assumes all figures in the ground; that of a pear, an almond, a pea, &c. In amber there have been said to be letters found very well formed; and even Hebrew and Arabic characters.—Within some pieces, leaves, insects, &c. have likewise been found included; which seems to indicate either that the amber was originally in a fluid state, or that having been exposed to the sun, it was once softened and rendered susceptible of the leaves, insects, &c. which came in its way. The latter of these suppositions seems the more agreeable to the phenomenon; because those insects, &c. are never found in the centre of the pieces of amber, but always near the surface. It is observed by the inhabitants of those places where amber is produced, that all animals, whether terrestrial, aerial, or aquatic, are extremely fond of it, and that pieces of it are frequently found in their excrements. The bodies of insects, found buried in amber, are viewed with admiration by all the world; but of the most remarkable of these, many are to be suspected as counterfeit, the great price at which beautiful specimens of this kind sell, having tempted ingenious cheats to introduce animal bodies in such artful manners, into seemingly whole pieces of amber, that it is not easy to detect the fraud.

Of those insects which have been originally enclosed in amber, some are plainly seen to have struggled hard for their liberty, and even to have left their limbs behind them in the attempt; it being no unusual thing to see, in a mass of amber that contains a stout beetle, the animal wanting one, or perhaps two of its legs; and those legs left in different places, nearer that part of the mass from which it has travelled. This also may account for the common accident of finding legs or

Amber. or wings of flies, without the rest of their bodies, in pieces of amber; the insects having, when entangled in the yet soft and viscid matter, escaped, at the expense of leaving those limbs behind them. Drops of clear water are sometimes also preserved in amber. These have doubtless been received into it while soft, and preserved by its hardening round them. Beautiful leaves of a pinnated structure, resembling some of the ferns, or maidenhairs, have been found in some pieces; but these are rare, and the specimens of great value. Mineral substances are also found at times lodged in masses of amber. Some of the pompous collections of the German princes boast of specimens of native gold and silver in masses of amber; but as there are many substances of the marcasite, and other kinds, that have all the glittering appearance of gold and silver, it is not to be too hastily concluded, that these metals are really lodged in these beds of amber. Iron is found in various shapes immersed in amber; and as it is often seen eroded, and sometimes in the state of vitriol, it is not impossible, but that copper, and the other metals, may be also sometimes immersed in it in the same state; hence the bluish and greenish colours, frequently found in the recent pieces of amber, may be owing, like the particles of the gem colours, to those metals; but as the gems, by their dense texture, always retain their colours, this lighter and more lax bitumen usually loses what it gets of this kind by keeping some time. Small pebbles, grains of sand, and fragments of other stones, are also not unfrequently found immersed in amber.

Naturalists have been greatly divided as to the origin of this substance, and what class of bodies it belongs to; some referring it to the vegetable, others to the mineral, and some even to the animal kingdom. Pliny describes it as "a resinous juice, oozing from aged pines and firs (others say from poplars, whereof there are whole forests on the coasts of Sweden), and discharged thence into the sea, where undergoing some alteration, it is thrown, in this form, upon the shores of Prussia, which lie very low: he adds, that it was hence the ancients gave it the denomination *succinum*; from *succus*, juice.

Some suppose amber a compound substance. Prussia, say they, and the other countries which produce amber, are moistened with a bituminous juice, which mixing with the vitriolic salts abounding in those places, the points of those salts fix its fluidity, whence it congeals; and the result of that congelation makes what we call amber; which is more or less pure, transparent and firm, as those parts of salt and bitumen are more or less pure, and are mixed in this or that proportion.

Mr Brydone, in his Tour to Sicily and Malta, says, that the river Gearetta, formerly celebrated by the poets under the name of Simetis, throws up near its mouth great quantities of amber. He mentions also a kind of artificial amber, not uncommon there, made, as he was told, from copal, but very different from the natural.

According to Hartman, amber is formed of a bitumen, mixed with vitriol and other salts. But though this were allowed him in regard to the fossil amber, many dispute whether the sea amber be so produced. It is, however, apparent, that all amber is of the

same origin, and probably that which is found in the sea has been washed thither out of the cliffs; though Hartman thinks it very possible, that some of it may be formed in the earth under the sea, and be washed up thence. The sea amber is usually finer to the eye than the fossil; but the reason is, that it is divested of the coarse coat with which the other is covered while in the earth.

Upon the whole, it seems generally agreed upon, that amber is a true bitumen of a fossil origin. In a late volume of the *Journal de Physique*, however, we find it asserted by Dr Girtanner to be an animal product, a sort of honey or wax formed by a species of large ant called by Linnæus *formica rufa*. These ants, our author informs us, inhabit the old pine forests, where they sometimes form hills about six feet in diameter: and it is generally in these ancient forests, or in places where they have been, that fossil amber is found. This substance is not hard as that which is taken up in the sea at Prussia, and which is well known to naturalists. It has the consistence of honey or of half melted wax, but it is of a yellow colour like common amber; it gives the same product by chemical analysis, and it hardens like the other when it is suffered to remain some time in a solution of common salt. This accounts for the insects that are so often found inclosed in it. Among these insects ants are always the most prevailing; which tends farther, Mr Girtanner thinks, to the confirmation of his hypothesis. Amber, then, in his opinion, is nothing but a vegetable oil rendered concrete by the acid of ants, just as wax is nothing but an oil hardened by the acid of bees; a fact incontestably proved, we are told, since Mr Methérie has been able to make artificial wax by mixing oil of olives with the nitrons acid, and which wax is not to be distinguished from the natural.

There are several indications which discover where amber is to be found. The surface of the earth is there covered with a soft scaly stone; and vitriol in particular always abounds there, which is sometimes found white, sometimes reduced into a matter like melted glass, and sometimes figured like petrified wood.

Amber of the finest kind has been found in England. It is frequently thrown on the shores of Yorkshire, and many other places, and found even in our clay pits; the pits dug for tile-clay, between Tyburn and Kensington gravel pits, and that behind St George's Hospital at Hyde-park corner, have afforded fine specimens.

Poland, Silesia, and Bohemia, are famous for the amber dug up there at this time. Germany affords great quantities of amber, as well dug up from the bowels of the earth, as tossed about on the shore of the sea and rivers there. Saxony, Misnia, Sweden, and many other places in this tract of Europe, abound with it. Denmark has afforded, at different times, several quantities of fossil amber; and the shores of the Baltic abound with it. But the countries lying on the Baltic afford it in the greatest abundance of all; and of these the most plentiful country is Prussia, and the next is Pomerania. Prussia was, as early as the time of Theodoric the Goth, famous for amber; for this substance coming into great repute with this prince, some natives of Prussia, who were about his court, offered their service to go to their own country, where that

Amber.

that substance, they said, was produced, and bring back great stores of it. They accordingly did so; and from this time Prussia had the honour to be called the country of amber, instead of Italy, which had before undeservedly that title. This article alone brings his Prussian majesty a revenue of 26,000 dollars annually. The amber of Prussia is not only found on the sea coasts, but in digging; and though that of Pomerania is generally brought from the shores, yet people who dig, on different occasions, in the very heart of the country, at times find amber.

Junker describes, after Neumann, the Prussian amber mines, which are the richest known. First, At the surface of the earth is found a stratum of sand. Immediately under this sand is a bed of clay, filled with small flints of about an inch diameter each. Under this clay lies a stratum of black earth or turf, filled with fossil wood, half decomposed and bituminous: this stratum is extended upon a bank of minerals, containing little metal except iron, which are consequently pyrites. Lastly, Under this bed the amber is found scattered about in pieces, or sometimes accumulated in heaps.

Amber has a subacid resinous taste, and fragrant aromatic smell, especially when dissolved. It differs from the other bituminous substances in this, that it yields by distillation a volatile acid salt, which none of the others do; otherwise it affords the same sort of principles as them, viz. an acid phlegm, an oil which gradually becomes thicker as the distillation is continued; and when the operation is finished, there remains a black caput mortuum in the retort. When boiled in water, it neither softens nor undergoes any sensible alteration. Exposed to the fire in an open vessel, it melts into a black mass very like a bitumen: It is partly soluble in spirit of wine, and likewise in some essential oils; but it is with difficulty that the expressed ones are brought to act upon it. The stronger sorts of fixed alkaline lixivia almost totally dissolve it.

This substance is principally of two colours, white and yellow. The white is the most esteemed for medicinal purposes, as being the most odoriferous, and containing the greatest quantity of volatile salt; though the yellow is most valued by those who manufacture beads and other toys with it, by reason of its transparency.

Amber is the basis of all varnishes, by solution in the ways described under the article VARNISH.

Amber, when it has once been melted, irrecoverably loses its beauty and hardness. There have been some, however, who pretended they had an art of melting some small pieces of amber into a mass, and constituting large ones of them: but this seems such another undertaking as the making of gold; all the trials that have yet been made by the most curious experimenters, proving, that the heat which is necessary to melt amber is sufficient to destroy it. (Phil. Trans. N^o 248. p. 25.).

Could amber indeed be dissolved without impairing its transparency, or one large mass be made of it by uniting several small ones, it is easy to see what would be the advantages of such a process. The art of embalming might possibly be also carried to a great height by this, if we could preserve the human corpse in a transparent case of amber, as the bodies of flies, spi-

ders, grasshoppers, &c. are to a great perfection.— Something of a substitute of this kind we have in fine rosin; which being dissolved by heat, and the bodies of small animals several times dipped in it, they are thus coated with colophony, that in some degree resembles amber; but this must be kept from dust.

Amber in substance has been much recommended as a nervous and cordial medicine; and alleged to be very efficacious in promoting the menstrual discharge, and the exclusion of the *fœtus* and secundines in labour: but as in its crude state it is quite insoluble by our juices, it certainly can have very little effect on the animal system, and therefore it is now seldom given in substance. The forms in which amber is prepared are, a tincture, a salt, and an oil; the preparations and uses of which are described in the proper place under the article PHARMACY.

AMBER Tree, the English name of a species of ANTHOSPERMUM.

AMBERG, a city of Germany, the capital of the upper palatinate of Bavaria, with a good castle, ramparts, and deep ditches. It is seated near the confines of Franconia, on the river Wils. It has a great trade in iron and other metals, which are found in the neighbouring mountains. E. Long. 12. 0. N. Lat. 49. 25.

AMBERG, a lofty mountain of East Gothland in Sweden. Near the Wetter lake on this mountain, antimony has been found. On its top is the burying-place of one of the ancient kings of the country. The spot is marked by a flat stone.

AMBERGRIS, AMBERGREASE, or GRAY-AMBER, in *Natural History*, is a solid, opaque, ash-coloured, fatty, inflammable substance, variegated like marble, remarkably light, rugged, and uneven in its surface, and has a fragrant odour when heated. It does not effervesce with acids: it melts freely over the fire into a kind of yellow rosin; and is hardly soluble in spirit of wine.

It is found swimming upon the sea, or the sea coast, or in the sand near the sea coast; especially in the Atlantic ocean, on the sea coast of Brazil, and that of Madagascar; on the coast of Africa, of the East Indies, China, Japan, and the Molucca islands: but most of the ambergris which is brought to England comes from the Bahama islands, from Providence, &c. where it is found on the coast. It is also sometimes found in the abdomen of whales by the whale fishermen, always in lumps of various shapes and sizes, weighing from half an ounce to a hundred and more pounds. The piece which the Dutch East India Company bought from the king of Tydore, weighed 182 pounds. An American fisherman from Antigua found some years ago, about fifty-two leagues south-east from the Windward islands, a piece of ambergris in a whale which weighed about a hundred and thirty pounds, and sold for 500l. sterling.

There have been many different opinions concerning the origin of this substance.

It has been supposed to be a fossil bitumen or naphtha, exuding out of the bowels of the earth in a fluid form, and distilling into the sea, where it hardens and floats on the surface. But having been frequently found in the bellies of whales, it has by others been considered as entirely an animal production.

Clusius asserted it to be a phlegmatic recrement, or indurated

Amber

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Ambergris.

Ambergris. indurated indigestible part of the food, collected and found in the stomach of the whale, in the same manner as the BEZOARS are found in the stomachs of other animals.

In an account communicated by Paul Dudley, Esq. in the 23d volume of the Philosophical Transactions, the ambergris found in whales is represented as a kind of animal product, like musk and castoreum, &c. secreted and collected in a particular bag or bladder, which is furnished with an excretory duct or canal, the spout of which runs tapering into and through the length of the penis; and that this bag, which just lies over the testicles, is almost full of a deep orange-coloured liquor, not quite so thick as oil, of the same smell as the balls of ambergris, which float and swim loose in it; which colour and liquor may also be found in the canal of the penis; and that therefore ambergris is never to be found in any female, but in the male only. But these circumstances are not only destitute of truth, but also contrary to the laws of the animal economy: For, in the first place, ambergris is frequently found in females as well as males; although that found in females is never in such large pieces, nor of so good a quality, as what is found in males. Secondly, No person who has the least knowledge in anatomy or physiology, will ever believe that organized bodies, such as the beaks of the sepia, which are so constantly found in ambergris taken out of the whale, can have been absorbed from the intestines by the lacteals or lymphatics, and collected with the ambergris in the precluded bag above mentioned.

Kæmpfer, who has given us so many other faithful accounts in natural history, seems to come nearer the truth with regard to the origin of ambergris, when he says, that it is the dung of the whale; and that the Japanese for this reason call it *kusura no fau*, i. e. whale's dung. This account, however, though founded on observation, has never obtained credit; but has been considered rather as a fabulous story, with which the Japanese imposed upon him, who had himself no direct observation to prove the fact.

This matter, therefore, remained a subject of great doubt; and it was generally thought to be more probable, that ambergris, after having been swallowed and somehow or other changed in the stomach and bowels of the whale, was found among its excrements.

But the most satisfactory account of the real origin of ambergris, is that given by Dr Swediaur in the 73d volume of the Philosophical Transactions, art. 15.

We are told by all writers on ambergris, that sometimes claws and beaks of birds, feathers of birds, parts of vegetables, shells, fish, and bones of fish, are found in the middle of it, or variously mixed with it. Of a very large quantity of pieces, however, which the Doctor examined, he found none that contained any such thing; though he allows that such substances may sometimes be found in it: but in all the pieces of any considerable size, whether found on the sea or in the whale, he constantly found a considerable quantity of black spots, which, after the most careful examination, appeared to be the beaks of the *Sepia Octopodia*; and these beaks, he thinks, might be the substances which have hitherto been always mistaken for claws or beaks of birds, or shells.

The presence of these beaks in ambergris proves evi-

dently, that all ambergris containing them is in its *Ambergris.* origin, or must have been once, of a very soft or liquid nature, as otherwise those beaks could not so constantly be intermixed with it throughout its whole substance.

That ambergris is found either upon the sea and sea-coast, or in the bowels of whales, is a matter of fact universally credited. But it has never been examined into and determined whether the ambergris found upon the sea and sea-coast, is the same as that found in the whale, or whether they are different from one another; whether that found on the sea or sea-coast has some properties, or constituent parts, which that found in the whale has not; and lastly, whether that found in the whale is superior or inferior in its qualities and value to the former.

It is likewise a matter of consequence to know, whether ambergris is found in all kinds of whales, or only in a particular species of them; whether it is constantly and always to be met with in those animals; and, if so, in what part of their body it is to be found?

All these questions we find very satisfactorily discussed by Dr Swediaur.

According to the best information that he could obtain from several of the most intelligent persons employed in the spermaceti whale fishery, and in procuring and selling ambergris, it appears, that this substance is sometimes found in the belly of the whale, but in that particular species only which is called the *spermaceti whale*, and which, from its description and delineation, appears to be the *PHYSETER Macrocephalus* Linnæi.

The New England fishermen, according to their account, have long known that ambergris is to be found in the spermaceti whale; and they are so convinced of this fact, that whenever they hear of a place where ambergris is found, they always conclude that the seas in that part are frequented by that species of whale.

The persons who are employed in the spermaceti whale fishery, confine their views to the physeter macrocephalus. They look for ambergris in all the spermaceti whales they catch, but it seldom happens that they find any. Whenever they hook a spermaceti whale, they observe, that it constantly not only vomits up whatever it has in its stomach, but also generally discharges its faeces at the same time; and if this latter circumstance takes place, they are generally disappointed in finding ambergris in its belly. But whenever they discover a spermaceti whale, male or female, which seems torpid and sickly, they are always pretty sure to find ambergris, as the whale in this state seldom voids its faeces upon being hooked. They likewise generally meet with it in the dead spermaceti whales, which they sometimes find floating on the sea. It is observed also, that the whale in which they find ambergris often has a morbid protuberance, or, as they express it, a kind of gathering in the lower part of its belly, in which, if cut open, ambergris is found. It is observed, that all those whales in whose bowels ambergris is found, seem not only torpid and sick, but are also constantly leaner than others; so that, if we may judge from the constant union of these two circumstances, it would seem that a larger collection of ambergris in the belly of the whale is a source of disease, and probably sometimes the cause of its death. As soon as they

Ambergris.

hook a whale of this description, torpid, sickly, emaciated, or one that does not dung on being hooked, they immediately either cut up the above-mentioned protuberance, if there be any, or they rip open its bowels from the orifice of the anus, and find the ambergris sometimes in one sometimes in different lumps, of generally from three to twelve and more inches in diameter, and from one pound to twenty or thirty pounds in weight, at the distance of two, but most frequently of about six or seven feet from the anus, and never higher up in the intestinal canal; which, according to their description, is in all probability the intestinum cæcum, hitherto mistaken for a peculiar bag made by nature for the secretion and collection of this singular substance. That the part they cut open to come at the ambergris is no other than the intestinal canal is certain, because they constantly begin their incision at the anus, and find the cavity everywhere filled with the fæces of the whale, which from their colour and smell it is impossible for them to mistake. The ambergris found in the intestinal canal is not so hard as that which is found on the sea or sea-coast, but soon grows hard in the air: when first taken out, it has nearly the same colour, and the same disagreeable smell, though not so strong, as the more liquid dung of the whale has; but on exposing it to the air, it by degrees not only grows grayish, and its surface is covered with a grayish dust, like old chocolate, but it also loses its disagreeable smell, and, when kept for a certain length of time, acquires the peculiar odour which is so agreeable to most people.

The gentlemen the Doctor conversed with confessed, that if they knew not from experience that ambergris thus found will in time acquire the above-mentioned qualities, they would by no means be able to distinguish ambergris from hard indurated fæces. This is so true, that whenever a whale voids its fæces upon being hooked, they look carefully to see if they cannot discover among the more liquid excrements (of which the whale discharges several barrels) some pieces floating on the sea of a more compact substance than the rest. These they take up and wash, knowing them to be ambergris.

In considering whether there be any material difference between the ambergris found upon the sea or sea-coast, and that found in the bowels or among the dung of the whale, the Doctor refutes the opinion, that all ambergris found in whales is of an inferior quality, and therefore much less in price. Ambergris, he observes, is only valued for its purity, lightness, compactness, colour, and smell. There are pieces of ambergris found on different coasts, which are of a very inferior quality; whereas there are often found in whales pieces of it of the first value; nay, several pieces found in the same whale, according to the above mentioned qualities, are more or less valuable. All ambergris found in whales has at first, when taken out of the intestines, very near the same smell as the liquid excrements of that animal have; it has then also nearly the same blackish colour: they find it in the whale sometimes quite hard, sometimes rather softish, but never so liquid as the natural fæces of that animal. And it is a matter of fact, that after being taken out and kept in the air, all ambergris grows not only harder and whiter, but also loses by degrees its smell, and assumes

Ambergris.

such an agreeable one, as that in general has which is found swimming upon the sea; therefore the goodness of ambergris seems rather to depend on its age. By being accumulated after a certain length of time in the intestinal canal, it seems even then to become of a whiter colour, and less ponderous, and to acquire its agreeable smell. The only reason why ambergris found floating on the sea generally possesses the above-mentioned qualities in a superior degree is, because it is commonly older, and has been longer exposed to the air. It is more frequently found in males than females; the pieces found in females are in general smaller, and those found in males seem constantly to be larger and of a better quality; and therefore the high price in proportion to the size is not merely imaginary for the rarity's sake, but in some respects well founded, because such large pieces appear to be of a greater age, and possess the above-mentioned qualities in general in a higher degree of perfection than smaller pieces.

It is known, that the sepia octopodia, or cuttle-fish, is the constant and natural food of the spermaceti whale, or physeter macrocephalus. Of this the fishers are so well persuaded, that whenever they discover any recent relics of it swimming on the sea, they conclude that a whale of this kind is, or has been, in that part. Another circumstance which corroborates the fact is, that the spermaceti whale, on being hooked, generally vomits up some remains of the sepia. Hence it is easy to account for the many beaks, or pieces of beaks, of the sepia, found in all ambergris. The beak of the sepia is a black horny substance, and therefore passes undigested through the stomach into the intestinal canal, where it is mixed with the fæces; after which it is either evacuated with them, or if these latter be preternaturally retained, forms concretions with them, which render the animal sick and torpid, and produce an obstruction, which ends either in an abscess of the abdomen, as has been frequently observed, or becomes fatal to the animal; whence, in both the cases, on the bursting of its belly, that hardened substance known under the name of *ambergris*, is found swimming on the sea or thrown upon the coast.

From the preceding account, and his having constantly found the above-mentioned beaks of the sepia in all pieces of ambergris of any considerable size, Dr Swediaur concludes, with great probability, that all ambergris is generated in the bowels of the physeter macrocephalus or spermaceti whale; and there mixed with the beaks of the sepia octopodia, which is the principal food of that whale. He therefore defines ambergris to be the preternaturally hardened dung or fæces of the physeter macrocephalus, mixed with some indigestible relics of its food.

The opinion of Dr Swediaur, with regard to the origin of ambergris, has been confirmed by the information of Captain J. Coffin, master of a ship employed in the southern whale fishery, given to a committee of privy council in the year 1791. According to Mr Coffin's information, American ships had sometimes found small quantities of ambergris; but none, that he knew of, had ever been found by British ships. The quantity which he had brought home amounted to 362 ounces; and it was taken from the body of a female spermaceti whale on the coast of Guinea, which

was

Ambergris. was lean, sickly, and old; and yielded but a small proportion of oil. While the people were employed in cutting up the blubber, ambergris was discovered coming from the fundament of the whale, and a piece of it was seen floating on the surface of the sea. More was observed in the same passage, and the rest was found in a hag a little below the passage and communicating with it. Mr Coffin supposes, that the spermaceti whale feeds almost wholly on the sepia or squid; for when the whale is dying, a quantity of this fish, sometimes whole, sometimes in pieces, is thrown up. The bills of the squid were found, some on the outside adhering to it, and some mixed with it. The spermaceti whale, when struck, generally voids her excrement, and if she does not, Mr Coffin conjectures, that she has no ambergris; for he supposes, that the production of it is the cause or the effect of some disorder; and that it is most likely to be found in a sickly fish. The ambergris of the whale taken by Mr Coffin was mostly sold at 19s. 9d. per ounce; and a small part of it, when it was scarce, at 25s. It was bought partly for home consumption, and partly for exportation to Turkey, Germany, and France. (Phil. Trans. vol. lxxxi.).

The use of ambergris in Europe is now nearly confined to perfumery, though it has formerly been recommended in medicine by several eminent physicians. Hence the *Essentia Ambræ Hoffmanni*, *Tinctura Regia Cod. Parisini*, *Trochisci de Ambra Ph. Wurtemberg, &c.*

If we wish to see any medicinal effects from this substance, the Doctor observes, we must certainly not expect them from two or three grains, but give rather as many scruples of it for a dose; though even then, he thinks, there would not be reason to expect much effect from it, as he had himself taken of pure unadulterated ambergris in powder 30 grains at once without observing the least sensible effect from it. A sailor, however, who had the curiosity to try the effect of recent ambergris upon himself, took half an ounce of it melted upon the fire, and found it a good purgative; which proves that it is not quite an inert substance.

In Asia and part of Africa ambergris is not only used as a medicine and a perfume; but considerable use is also made of it in cookery, by adding it to several dishes as a spice. A great quantity of it is also constantly bought by the pilgrims who travel to Mecca; probably to offer it there, and make use of it in fumigations, in the same manner as frankincense is used in Catholic countries. The Turks make use of it as an aphrodisiac. Our perfumers add it to scented pillars, candles, balls, bottles, gloves, and hairpowder; and its essence is mixed with pomatums; for the face and hands, either alone or mixed with musk, &c. though its smell is to some persons extremely offensive.

Ambergris may be known to be genuine by its fragrant scent when a hot needle or pin is thrust into it, and its melting like fat of an uniform consistence; whereas the counterfeit will not yield such a smell, nor prove of such a fat texture. One thing, however, is very remarkable, that this drug, which is the most sweet of all the perfumes, should be capable of being

resembled in smell by a preparation of one of the most odious of all stinks. Mr Homberg found that a vessel in which he had made a long digestion of human fæces, acquired a very strong and perfect smell of ambergris, insomuch that any one would have thought a great quantity of essence of ambergris had been made in it. The perfume was so strong and offensive, that the vessel was forced to be removed out of the laboratory.

AMBERT, a small town of France, in the department of Puy de Dome, formerly Lower Auvergne. It is the chief place of a small territory called *Livradois*. Paper and playing cards, camblets, and woollen stuffs are manufactured here. E. Long. 3. 48. N. Lat. 45. 33.

AMBETTUWAY, a barbarous name of a tree, the leaves of which, when boiled in wine, are said to create an appetite, and are used by the people in Guinea with that intention.

AMBIANI, or AMBIANENSIS CIVITAS, now *Amiens*, a city of Picardy. It is called *Samarobriva* by Caesar and Cicero: which, according to Valesius, signifies the bridge of the *Samara*, or *Somme*. *Ambiani* is a later name, taken from that of the people, after the usual manner of the lower age. This people, according to Caesar, furnished 5000 men for the siege of Alesia.

AMBIDEXTER, a person who can use both hands with the same facility, and for the same purposes, that the generality of people do their right hands. As to the natural cause of this faculty, some, as Hæfer, attribute it to an extraordinary supply of blood and spirits from the heart and brain, which furnishes both hands with the necessary strength and agility; others, as Nicholas Massa, to an erect situation of the heart, inclining neither to the right hand nor the left; and others to the right and left subclavian arteries being of the same height, and the same distance from the heart, by which the blood is propelled with equal force to both hands. But these are only conjectures, or rather chimeras. Many think, that were it not for education and habit, all mankind would be ambidexters; and in fact, we frequently find nurses obliged to be at a good deal of pains before they can bring children to forego the use of their left hands. How far it may be an advantage to be deprived of half our natural dexterity, may be doubted. It is certain, there are infinite occasions in life, when it would be better to have the equal use of both hands. Surgeons and oculists are of necessity obliged to be ambidexters; bleeding, &c. in the left arm or left ankle, and operations on the left eye, cannot be well performed but with the left hand. —Various instances occur in history, where the left hand has been exercised preferably to the right. But by the laws of the ancient Scythians, people were enjoined to exercise both hands alike; and Plato enjoins ambidexterity to be observed and encouraged in his republic.

AMBIDEXTER, among *English Lawyers*, a juror or embracer, who accepts money of both parties, for giving his verdict: an offence for which he is liable to be imprisoned, for ever excluded from a jury, and to pay ten times the sum he accepted.

AMBIENT, a term used for such bodies, especially fluids,

Ambient
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Ambitus.

fluids, as encompass others on all sides : thus, the air is frequently called an ambient fluid, because it is diffused round the earth.

AMBIERLE, a town of France, in the department of the Rhone and Loire. It is the chief place of a canton in a district of Roanne.

AMBIGENÆ OVES, in the heathen sacrifices, an appellation given to such ewes as, having brought forth twins, were sacrificed, together with their two lambs, one on each side. We find them mentioned among other sacrifices to Juno.

AMBIGENAL HYPERBOLA, a name given by Sir Isaac Newton to one of the triple hyperbolas of the second order, having one of its infinite legs falling within an angle formed by the asymptotes, and the other without.

AMBIGUITY, a defect of language, whereby words are rendered ambiguous. See the next article.

AMBIGUOUS, a term applied to a word or expression which may be taken in different senses. An anonymous writer has published a dictionary of ambiguous words : *Lexicon Philosophicum de Ambiguitate Vocabulorum*, Francof. 1597, 4to.—The responses of the ancient oracles were always ambiguous.

AMBIT, in *Geometry*, is the same with what is otherwise called the perimeter of a figure. See **PERIMETER**.

AMBIT was particularly used, in antiquity, to denote a space of ground to be left vacant betwixt one building and another. By the laws of the twelve tables, houses were not to be built contiguous, but an ambit or space of $2\frac{1}{2}$ feet was to be left about each for fear of fire.—The ambitus of a tomb or monument denoted a certain number of feet, in length and breadth, around the same, within which the sanctity assigned to it was limited. The whole ground wherein a tomb was erected was not to be secreted from the common uses ; for this reason, it was frequent to inscribe the ambit on it, that it might be known how far its sanctity extended : thus, *in fronte pedes tot, in agrum pedes tot*.

AMBITION (*ambitio*) is generally used in a bad sense, for an immoderate or illegal pursuit of power.

In the strict meaning, however, of the word, it signifies the same with the *ambitus* of the Romans. See the next article.

Ambition, in the former and more usual sense, is one of those passions that is never to be satisfied. It swells gradually with success ; and every acquisition serves but as a spur to further attempts.

“ If a man (it has been well observed) could at once accomplish all his desires, he would be a miserable creature ; for the chief pleasure of this life is to wish and desire. Upon this account, every prince who aspires to be despotic aspires to die of weariness. Searching every kingdom for the man who has the least comfort in life, Where is he to be found ?—In the royal palace.—What ! his Majesty ? Yes, especially if he be despotic.”

AMBITUS, in *Roman Antiquity*, the setting up for some magistracy or office, and formally going round the city to solicit the interest and votes of the people.

Ambitus differed from *ambition*, as the former lies in the act, the latter in the mind.

Ambitus
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Ambo.

Ambitus was of two kinds ; one lawful, the other infamous. The first, called also *ambitus popularis*, was when a person offered his service to the republic frankly, leaving it to every body to judge of his pretensions as they found reasonable. The means and instruments here made use of were various. 1. *Amici*, or friends, under different relations, including *cognati, affines, necessarii, familiares, vicini, tribules, clientes, municipes, sodales, collegæ*. 2. *Nomenclatura*, or the calling and saluting every person by his name ; to which purpose, the candidates were attended by an officer, under the denomination of *interpretes*, or *nomenclatores*. 3. *Blanditia*, or obliging persons, by serving them, or their friends, patrons, or the like, with their vote and interest on other occasions. 4. *Prensatio*, the shaking every person by the hand, offering him his service, friendship, &c. The second kind was that wherein force, cajoling, money, or other extraordinary influence, was made use of. This was held infamous, and severely punished, as a source of corruption and other mischiefs.

Ambitus was practised, not only at Rome, and in the forum, but in the meetings and assemblies of other towns in Italy, where numbers of citizens were usually found, on account of trade and business. The practice ceased in the city from the time of the emperors, by reason posts were not then to be had by courting the people, but by favour from the prince.

Persons who had causes depending practised the same, going about among the judges to implore their favour and mercy. They who practised this were called *Ambitiosi*. Hence we also meet with *ambitiosa decreta*, and *ambitiosa justa*, used for such sentences and decrees as were thus procured from the judges, contrary to reason and equity, either gratuitously or for money.

AMBLE, in *Horsemanship*, a peculiar pace by which a horse's two legs of the same side move at the same time. See **HORSEMANSHIP**.

AMBLESIDE, a town in Westmoreland, seated at one end of Winandermeer. W. Long. o. 49. N. Lat. 54. 30.

AMBLETEUSE, a sea-port-town of France, in the department of the Straits of Calais, in the English Channel, twelve miles south-west from Calais, and eight north from Boulogne. At this port Caesar embarked his cavalry when he invaded England ; and James II. when he abdicated the crown landed. It is defended with a battery of cannon. E. Long. 1. 37. N. Lat. 50. 48.

AMBLYGON, in *Geometry*, denotes an obtuse-angled triangle, or a triangle one of whose angles consists of more than 90 degrees.

AMBLYOPY, among physicians, signifies an obscuration of the sight, so that objects at a distance cannot be clearly distinguished.

AMBO, or **AMBON**, a kind of pulpit or desk, in the ancient churches, where the priests and deacons stood to read or sing part of the service, and preach to the people ; called also *Analogium*. The term is derived from *αναβαινω*, “ to mount.” The ambo was mounted upon two sides ; whence some also derive the appellation from the Latin *ambo*, “ both.”

The ambo was ascended by steps ; which occasioned that

Ambo that part of the office performed there to be called the *Gradual*. See *GRADUAL*.

Amboise.

Besides the gospel, which was read at the top of the ambo, and the epistle, which was read a step lower, they likewise published from this place the acts of the martyrs, the commemoration of departed saints, and the letters of peace and communion sent by one church to another: here, too converts made a public profession of their faith; and bishops their defence, when accused; treaties also were sometimes concluded, and the coronations of emperors and kings performed, in the same place.

The modern reading-desks and pulpits have been generally substituted for the ancient ambos; though, in some churches remains of the ambos are still seen. In that of St John de Lateran at Rome, there are two moveable ambos.

AMBOHITSMENE, or VOHITSANGHOMBE, a province of the island of Madagascar, so called from some red mountains of the same name, lying in S. Lat. 20°. These mountains are very high, resembling the Tafelberg of the Cape of Good Hope. On one side of this ridge the sea extends into the country for fifteen leagues; on the other is a flat country, abounding in ponds and marshes. Here is also a lake of 15 leagues in length, and the same in breadth, containing many small islands. The inhabitants of the mountains are called *Zaferahongs*; and have plenty of gold, iron, cattle, silk, &c.

AMBOISE, a town of France, in the former province of Touraine, now the department of the Indre and Loire, seated at the confluence of the rivers Loire and Masse. The town is the capital of a district, and has been rendered famous in history by the conspiracy of the Protestants in 1560, which opened the fatal wars of religion in France. The castle is situated on a craggy rock, extremely difficult of access, and the sides of which are almost perpendicular. At its foot flows the Loire, which is divided into two streams by a small island. To this fortress the duke of Guise, when he expected an insurrection among the Huguenots, removed Francis II. as to a place of perfect security. Only two detached parts of the ancient castle now remain, one of which was constructed by Charles VIII. and the other by Francis I. The former of these princes was born and died at Amboise. The town is situated in E. Long. 0. 34. N. Lat. 47. 25.

AMBOISE, D', Francis, son of a surgeon to Charles IX. of France. He very early obtained the patronage of that prince, and was supported by his liberality in the prosecution of his studies at the university of Navarre, where he devoted his talents to rhetoric and philosophy with great assiduity and success. His eloquence and extensive information raised him in 1572 to the place of solicitor of the French nation. He afterwards applied to the study of the law, and became one of the most accomplished advocates of the parliament of Paris. He was next advanced to be counsellor in the parliament of Bretagne, and next to be a master of requests and counsellor of state. He visited different countries, and published the history of his travels, with several poetical pieces. He prefixed an apologetical preface to the edition of Abelard's works in 1616, and with much industry collected many of his manuscripts. His

brother Adrian rose to considerable consequence in the church; and his brother James was not less eminent as a physician. (*Gen. Dict.*)

AMBOISE, D', George, a French cardinal and minister of state, was born in the year 1460. His father was a descendant of the renowned house of Amboise, and, through the influence of his powerful connexions, he beheld the path of church preferment open before his son; therefore he destined him to the clerical order. In these sanguine expectations he was not disappointed; for he had sufficient influence to procure for him the bishopric of Montauban at the early age of fourteen. Louis XI. appointed him one of his almoners; and in the course of political events, he became strongly attached to the duke of Orleans, and suffered imprisonment in his cause. When this prince, however, had regained his favour at court, he was elevated to the archbishopric of Narbonne. After he had remained there for some time, he changed that station for the archbishopric of Ronen. When the duke of Orleans was governor of Normandy, he made him lieutenant general; and in that situation he was of essential service to the province, in restoring justice and order. When the duke of Orleans became Louis XII. Amboise was suddenly raised to the elevated station of first minister and one of the cardinals. The same regard to equity, which characterized his conduct when lieutenant general, induced him to diminish the imposts, which rendered him very popular as first minister of France. In 1499, by his advice, the king undertook the conquest of the Milanese, and, on their revolt, the first minister was sent to quell the rebellion. The great confidence which Louis had reposed in him, induced the pope to make him his legate in France; and, in that station, he piously laboured to reform the ecclesiastical orders. He enforced his doctrine by precept, not only in setting them an example of holding no more benefices than one at a time, but also by devoting two-thirds of the revenue of the same to the poor, and to the repair of religious edifices. According to his own account he was ambitious of the papal chair, "merely for the purpose of effecting the reformation of abuses and the correction of manners." It is reported that, upon the death of Pius III. he would have been elected pope had he not been deceived by the Italian cardinals. Disappointed in his views with regard to the papal honours, he persuaded his master to declare war against the Venetians, to whose influence he supposed his failure was owing. But this imprudent undertaking was suddenly interrupted; for in the prosecution of his journey for the Venetian war, he was seized with an illness, and confined in the city of Lyons. Affliction rouses the reflecting powers of the mind, and calls to remembrance the past actions of life. From the consciousness of his past errors and faults he was induced to express his contrition to a brother of the infirmity who attended him at the convent of the Celestines. In the year 1510, and in the 50th of his age, he breathed his last in that place. Industry, steadiness, and good intention, characterized his conduct as a prime minister. He shone with peculiar brightness as a man of literature. By his liberality and patronage, the arts and sciences flourished under his administration. It may be proper to add, that, assisted by some

of

Amboise

Amboyna.

of the ablest lawyers in the kingdom, he formed a code of laws to reform the reigning abuses in the nation. Thus, by steadily pursuing the general welfare, he obtained the appellation of the "father of the people." (*Gen. Biog.*).

AMBOULE, a province of Madagascar, somewhat to the northward of S. Lat. 23°. It is a fertile and agreeable country, watered by the river Manampani, whose mouth lies in S. Lat. 23. 30. The country produces plants and fruits in plenty. Iron mines are also found here. The black cattle are extremely fat, and their flesh excellent. In this province stands a large town of the same name; near which is a fountain of hot water, within 20 feet of a small river whose sand is almost burning. The water of the fountain is said to boil an egg hard in two hours; and the inhabitants affirm it to be a sovereign remedy against the gout. The people here are employed in different preparations of iron and steel, which they have from their own mines, and forge several instruments with tolerable skill. Their governor is honoured with the title of *Rabertau*, or *Great Lord*. He exercises sovereign authority and absolute power; but is frequently, in times of distress, surprised by his subjects, who assemble in great numbers, seize his person, and threaten him with death unless they are relieved. To extricate himself from this dilemma, he is instantly obliged to issue orders for distributing provisions among them; but is usually repaid with interest, a quadruple return being made in a plentiful harvest. The people of Amboule live in great licentiousness with their superiors, and their country is generally a retreat for the rognish and lazy.

AMBOYNA, one of the Molucca islands in the East Indies. It lies in S. Lat. 3. 36. and E. Long. 128. 20. and is remarkable for being the centre of the commerce for nutmegs and cloves, which is entirely monopolized by the Dutch East India Company. It is about 24 leagues in circumference. Besides cloves, it likewise abounds in most of the tropical fruits and fish; nor is there here any deficiency of good water; but flesh is very scarce. This scarcity, however, proceeds more from the policy of the Dutch than either the intemperance of the climate, or the barrenness of the soil: For excepting cloves, they have in Amboyna, as well as the Moluccas, industriously discouraged the cultivation of every esculent commodity, with the view of withholding subsistence from those who might be tempted to invade them.

Of the natives the men wear large whiskers, but leave little hair upon the chin; and have only a slight piece of stuff wrapped round their middle. The women tie their hair in knots: the maids are bought of their fathers before they are married; and if the wife proves barren, the marriage is dissolved. Some of the natives are Mahometans, and some Christians: but they are all said to be lazy, deceitful, and treacherous. They make war with small swift vessels, in shape like dragons with regard to the head and tail. Their houses are built of bamboo canes and sago trees. They sleep on mats. Their weapons are bows and arrows, javelins, scimitars, and targets.

Amboyna was first discovered by the Portuguese, who built a fort upon it, which was taken from them by the Dutch in 1605. They did not, however, become masters of the whole island at once. The Eng-

Amboyna.

lish had here five factors, who lived under the protection of the Dutch castle; holding themselves safe, in respect of the friendship between the two nations. Great differences had arisen between the Dutch and English colonists in this part of the world; till at last, the English East India Company applying to King James, a treaty was concluded in 1619, by which the concerns both of the English and Dutch were regulated, and certain measures agreed upon for preventing future disputes. This was an additional security to the English; and by virtue of the treaty, they continued two years in Amboyna, trading with the Dutch. During this time, however, several disputes happened; which occasioning mutual discontents, the complaints were sent to Jacatra, in the island of Java Major, to the council of defence of both nations resident there: but they not agreeing, a state of the matter was sent over to Europe, to be decided by the East India Companies of both nations; or, in case they could not agree, by the king of England and the states of Holland, according to an article in the treaty of 1619.—But before these disputes could be decided in a legal way, the Dutch, in order to give the more specious colouring to the violent seizure which they meditated of the island of Amboyna, made use of the stale pretext of a conspiracy being formed by the English and Japanese to dispossess them of one of their forts in this place. This plot, it was alleged, had been confessed by a Japanese and Portuguese in the English service, who were most inhumanly tortured till they should answer in the affirmative such interrogatories as might favour the secret design of those cruel inquisitors. Upon the injurious evidence of this constrained declaration, they immediately accused the English factors of the pretended conspiracy. Some of them they imprisoned, and others they loaded with irons, and sent on board their ships; seizing at the same time all the English merchandise, and their writings and books.

These acts of violence were followed by a scene of horror unexampled in the punishment of the most atrocious offenders. Some of the factors they tortured, by compelling them to swallow water till their bodies were distended to the utmost pitch; then taking the miserable victims down from the boards to which they had been fastened, and causing them to disgorge the water: if they did not acknowledge the imputed guilt, the process of torture was repeated. Others of the English they consumed by burning them gradually from the feet upwards, in order to extort the confession of a conspiracy, which was only pretended by the infernal policy of those savage tormentors. Some had the nails of the fingers and toes torn off; and in some they made holes in their breasts, filling the cavities with inflammable materials, to which they afterwards put fire. Those who did not expire under the agonies of torture were consigned to the hands of the executioner.

The allegation of this pretended conspiracy was equally void of probability and truth. The Dutch had a garrison of 300 men in the fort, besides the burghers in the town and several other forts and garrisons in the island, while the number of the English did not amount to 20 men; nor were even those provided with arms or ammunition to effect such a design as that which they were charged. There likewise was not one

English

Amboyna.

English vessel in the harbour, whereas the Dutch had eight ships riding near the town: neither, when the Dutch broke open the desks and trunks of the factors, was there found a single paper or letter which could be construed into the most distant relation to any conspiracy. Add to all this, that such of the unhappy sufferers as could speak to be heard, declared in the most solemn manner their innocence of the plot with which they were charged.

The whole of the transaction affords the most irrefragable testimony, that it was founded entirely upon a political fiction of the Hollanders, who had themselves formed the design of monopolizing the trade of the Spice Islands; for the accomplishment of which they perpetrated about the same time, a similar tragedy at Poolerou, where they put to the torture 162 of the natives, whom they likewise charged with a pretended conspiracy. It may justly be reckoned singular in the fortune of this commercial republic, that they have ever since been permitted to enjoy in peace those invaluable islands, which were originally obtained by such atrocious infringements of humanity and the laws of nations, as will stain the Dutch annals, to the latest ages, with indelible infamy.

The more effectually to preserve this trade, the Dutch have had all the clove trees in the adjacent islands grubbed up. Sometimes also, when the harvest is very large, part of the produce of Amboyna itself is burnt.—To prevent the rearing of cloves in any of the neighbouring islands, or the inhabitants from selling them to strangers, the governor of Amboyna makes the tour of his government with a fleet of *curricurries*, consisting sometimes of 20, and at others of 30, 40, or 50 sail. This expedition is made with all the pomp imaginable, in order to gratify the pride and folly of the Indian chiefs. The true reason of their taking all this pains is, because experience has shown, that no contracts, however solemn, can prevent the inhabitants of those islands from selling their spice to strangers: and even now, frauds are so frequently practised by the Dutch themselves, though the Company is inexorable in punishing them, that the common people call the cloves *galken kruid*, that is, the gallows spice.

Besides the cloves, coffee is also cultivated here by the Dutch, and a gold mine has been lately found out. This was discovered by the quantities of gold dust that were washed from some mountains by the torrents. Here also grow several kinds of valuable wood, of which they make tables, chairs, *escrutoires*, &c. for the principal persons in the government; and the rest is sold all over the Indies at a very extravagant rate.

Amboyna is divided into two parts, viz. a greater and lesser peninsula. The former, called *Hiton*, is 12 leagues in length, and two and a half broad. The other is called *Leytimor*, five leagues in length, and one and a half broad; on this stands the fort of Victoria, which is the residence of the governor. The fortress is a square, the ramparts mounted with 60 pieces of brass cannon, and the garrison usually composed of 600 men. It is so strong by nature and art, as to be in a manner impregnable, and so effectually does it command the harbour, that no vessel could come in or go out without being sunk by the cannon, if the governor chose. The inhabitants of Amboyna are

computed at 70,000 or 80,000, of whom but a small number are Dutch: and this obliges the latter to be continually upon their guard, and to keep a competent number of troops in each of their forts, particularly in that of Middleburgh, which stands upon the isthmus that connects these peninsulas. There are also redoubts and garrisons in all the islands of this government. Amboyna was taken by the British in 1796, restored in 1801, retaken in 1810, and finally restored to the Dutch at the peace in 1814. See AMBOYNA, SUPPLEMENT.

Amboyna,
Ambracia.

AMBRACIA, one of the most considerable cities of ancient Epirus, situated on the river Aracthus, at a small distance from the sea. At first it was a free city; but was afterwards reduced by the *Æacidæ* kings of Epirus, who chose it for the place of their residence. In process of time, the *Ætolians* made themselves masters of it, and held it till the year before Christ 189, when it fell into the hands of the Romans.

At this time Ambracia was a place of great strength. It was defended on one side by the river Aracthus, and on the other by steep and craggy hills; and surrounded with a high and thick wall, about three miles in compass. The Roman consul Fulvius began the siege by forming two camps, separated by the river, but with a communication between them; the Romans were posted in one, and the Epirots their allies in the other. He then threw up two lines, one of circumvallation, the other of contravallation; and built a wooden tower in form of a castle, over against the citadel, which stood on a hill. The *Ætolians*, however, before the lines were quite finished, found means to throw about 1000 men into the place.

The lines being completed, the city was attacked in five different places at once. The battering rams shook the wall on all sides: and the Romans, from their moveable towers, pulled down the battlements with a kind of scythes, which they fastened to long beams. The besieged made a vigorous defence. They were night and day on the walls, and indefatigable in preventing the effects of the rams and scythes. The strokes of the former they deadened, by letting down beams, large stones, lumps of lead, &c. by means of pulleys, upon them when they were in motion: the others they rendered useless, by pulling the beams to which they were fastened into the city with hooks contrived for the purpose.

While Fulvius was carrying on the siege, Nicander the *Ætolian* prætor, found means to throw 500 men into the city, under the command of one Nicodamus, with whom Nicander agreed to attack the Roman camp in the night-time; not doubting, that, if the garrison from within, and the army from without, fell upon them at the same time, they would be obliged to raise the siege. Nicodamus narrowly watched the time at which he was ordered to sally; and though Nicander did not appear, marched out at the head of the garrison, armed with firebrands and torches. The Roman sentinels, surprised at this sight, ran to awake the legionaries, and soon spread a general alarm all over the camp. The legionaries marched in small bodies as they happened to meet, to repulse the enemy, whom they engaged in three different places. Two parties of the garrison were driven back; but the third, commanded

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Ambracia, by two Ætolian generals, made a great slaughter of the Romans, and not finding themselves seconded by Nican-
Ambreada der, retired in good order into the city.

Though the besieged were thus abandoned and had no hopes of assistance, they continued to defend themselves with incredible vigour and resolution. The Romans had no sooner made a breach in the wall, but it was repaired, and a new one built behind it. The consul, therefore, altered his measures; and, instead of making breaches with the ram, began to undermine the wall, in hopes of throwing down great part of it at once, and entering the city before the besieged could have time to build a new wall. The miners being covered, were not observed by the garrison, till the great quantities of earth brought out of the mine gave the alarm. The Ætolians immediately began to counter-mine; and having dug a trench of the depth they supposed the mine to be, they carried it along the wall where they heard the strokes of the pickaxes of the Romans. When the two mines met, a battle ensued, first with pickaxes and spades, and then with swords and spears: but this attack did not last long, each party making themselves a kind of rampart with the loose earth. The Ætolians, in order to drive their enemies quite out of the mine, invented a machine which they brought to the place where the two mines met: this was a hollow vessel with an iron bottom, bored through in many places, and armed with spikes at proper distances, to prevent the enemy from approaching it: this vessel they filled with feathers, which they set on fire, and with bellows driving the smoke on the besiegers, obliged them to leave the mine half suffocated. This interval the Ætolians made use of in repairing the foundations of the wall.

The vigorous resistance made by the Ambracians, however, did not raise the courage of the nation in general, who were determined on a peace with Rome at all events. Fulvius, in the mean time, being desirous of getting possession of Ambracia before the conclusion of the peace, employed Amynder, king of the Athamans, to persuade the inhabitants to surrender. As Amynder had great interest in Ambracia, having long resided there, he easily persuaded them to capitulate on the following terms, viz. That the Ætolian garrison should have leave to march out of the city; that the inhabitants should pay 500 talents, 200 down, and the rest at six equal payments; and that they should deliver to the consul all the prisoners and deserters that were in the city. The gates were then opened to Fulvius; and he was presented with a crown of gold, together with many fine statues and pictures, of which there were great numbers in the city, it having been the capital of Pyrrhus, who had enriched it with many valuable monuments.

From this time the city of Ambracia made no figure in history. It is scarcely known at present where the city stood; but that called *Arba*, in Upper Albania, seems best to agree with what is said of the ancient situation of this city. The river *Aractus*, on which Ambracia was situated, is now called by the natives *Spagmagmuri*.

AMBREADA, thus they call the false or fictitious amber, which the Europeans use in their trade with the negroes on the coast of Africa, and particularly on the river Senegal. There are some large and red

pieces of it, a thousand of which making twenty ropes or strings, weigh three pounds. There are others small, and also red, which weigh but two pounds and a half.

AMBRESBURY, or AMESBURY, a market town in Wiltshire, about six miles north of Salisbury, and situated in W. Long. 1. 40. and N. Lat. 51. 20.

AMBRONES, a Gaulish people who lived near the foot of the Alps, between Switzerland and Provence. They invaded the Roman territories in conjunction with the Cimbri and Teutones; but were defeated with great slaughter by Marius, about 101 years before Christ. Their women, who had staid during the engagement in a kind of fortification made with their carts, on seeing their husbands flying, and the Romans at their heels, armed themselves with axes, and, gnashing with their teeth, fell with fury on the pursuers and the pursued. Their first rage being spent, they desired to surrender themselves, upon the single condition, that their chastity should not be violated; but this equitable request being denied, they first killed their children, and then themselves, not one remaining alive out of the whole multitude.

AMBROSE, SAINT, an island in the South Pacific ocean, on the coast of Chili, four or five leagues due west from St Felix island. At first view, it appears like two small islands; but after a nearer approach, it is found they are joined by a reef. It lies in S. Lat. 26. 13. W. Long. 80. 55. from Greenwich. There is a large rock four miles to the northward of the island, called from its appearance *Sail-rock*. Captain Roberts, who was here in 1792, found St Felix island inaccessible. On St Ambrose island, his crew killed and cured 13,000 seal skins of the best quality, in seven weeks. The island has little else to recommend it. Fish and crawfish abound. The best season for sealing is from the 1st of April to the 1st of August.

AMBROSE of Alexandria, lived in the beginning of the third century, and was the intimate friend of Origen. Jerome and Eusebius differ in the account they give of this man. The one denominates him a Marcionite, the other a Valentinian; but they both agree that he was converted to the orthodox faith, through means of the preaching of Origen. As is generally the case with new proselytes, he became very zealous, and was appointed deacon either at Alexandria, or at Cæsarea, where Protectetus was presbyter. Origen dedicated many of his works, and among others his book on martyrdom, to Ambrose; at whose desire and expence they were published. Origen and Ambrose were alike indefatigable in their application to study, and lived in terms of the most intimate friendship. Origen being poor, Ambrose assisted him, by providing notaries and amanuenses to copy his works.

In that period of society, when the increase of copies was a work of immense labour and great expence, these were not only instances of private friendship, but of public utility. Ambrose is thus justly entitled to rank among the patrons of learning. Ambrose has been blamed by some, for having made no provision at his death for the poor infirm Origen. The friends of Ambrose excuse this part of his conduct, by saying that Origen chose to live poor, and daily dependant on

Ambreada
 Ambrose.

Ambrose.

a divine Providence. According to some historians, Ambrose died as a martyr, along with his friend Proctetus, in the persecution under Maximin, about the year 236; but the dedication of Origen's eight books against Celsus shews, that though he died before Origen, yet he lived to the year 250, or near that period. Origen speaks of him as a man of great piety, and much devoted to the study of the sacred Scriptures. (*Gen. Biog.*).

AMBROSE, bishop of Milan, was one of the most eminent fathers of the church in the fourth century. He was a citizen of Rome, and born in France; some historians say in the year 334; but others say in the year 340. The birth of Ambrose is said to have been attended with a remarkable presage of his future eloquence, by a swarm of bees coming and settling upon his mouth as he lay in his cradle. At the period of his birth, his father was Prætorian prefect of Gallia Narbonensis; but, upon his death, the widow repaired to Rome with her family. Ambrose received a religious education, and was reared in the habits of virtuous conduct by his mother, who was an accomplished woman, and eminent for piety. The names of those masters who instructed him in the rudiments of the Greek and Roman literature have not been transmitted to posterity: but in these branches he made early proficiency; and, having directed his attention to the law, he employed his eloquence with such reputation in the Prætorian court of Anicius Probus, that he was soon deemed worthy of a place in the council. After he had continued in this station for some time, Probus appointed him consular of Liguria and Emilia, comprehending the territories of Milan, Liguria, Turin, Genoa, and Bologna. Milan was chosen for the place of his residence, and by the prudent and gentle use of his power, he conducted the affairs of the province with general approbation and growing popularity.

In the year 374, Auxentius the bishop of that city died, and his death gave a sudden change to the fortune and literary pursuits of Ambrose. At that period, the tide of religious contention ran high between the Catholics and the Arians, and there ensued a strong contest concerning the choice of a new bishop. When the people were assembled in the church to elect, Ambrose, in the character of governor of the place, went into the assembly, and in a grave, eloquent, and pathetic address, admonished the multitude to lay aside their contentions, and, in the spirit of religious meekness, to proceed to the important work of choosing a bishop. It is reported, that when Ambrose had finished his address, a child cried out, "Ambrose is bishop." The agitated multitude suddenly caught the superstitious flame, and regarding this as a miraculous intimation, they unanimously elected Ambrose bishop of Milan. Some suppose that this was entirely a device of Ambrose or his friends, and others ascribe it to mere accident. Ambrose strongly affected reluctance, and even pretended to fly from the city in order to avoid the intended honour. It is, however, unfortunate for the artifice of the governor, that the place of his concealment was soon discovered, when the will of the emperor was known concerning the confirmation of his election. Finding it inconvenient any longer to resist

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the public choice, he exchanged the ensigns of civil for those of ecclesiastical dignity; and, after being baptized, he was ordained bishop of Milan, about the end of the year 374.

But whatever may be the sentiments of mankind concerning the singular conduct of Ambrose in accepting an office for which he was certainly unqualified in respect of previous studies, habits, and employments, yet it must be admitted, that he immediately betook himself to the necessary studies, and with ability, boldness, and integrity, acquitted himself in his new elevation. Having appropriated his money to the poor, settled his lands upon the church, with the exception of making his sister tenant during life, and having committed the care of his family to his brother, he entered upon a regular course of theological study, under the care of Simplician, a presbyter of Rome, and devoted himself to the labours of the church.

Compelled by the irruption of the Goths and the northern barbarians, who rushed down upon the Roman empire, spreading terror and desolation all around, Ambrose, along with several others, fled to Illyricum; but he remained only a short period in exile, for the northern invaders were quickly defeated by the forces of the emperor, and driven back with considerable loss into their own dominions; therefore, he and his companions returned to their respective habitations.

After he returned to his ecclesiastic station, the eloquence and abilities of that zealous bishop found ample scope in the dispute between the Arians and the Catholics. About this era, the doctrine of Arius concerning the person of Christ had been extensively received, and had many powerful defenders both among the clergy and the common people. Ambrose espoused the cause of the Catholics. Gratian, the son of the elder Valentinian, marshalled on the same side. But the younger Valentinian, who was now become his colleague in the empire, adopted the opinions of the Arians; and all the arguments and eloquence of Ambrose were insufficient to reclaim the young prince to the orthodox faith. Theodosius, the emperor of the east, also professed the orthodox faith, yet there were numerous adherents to Arius scattered throughout his dominions. In this general state of religious opinions in the empire, two leaders of the Arians, Palladius and Secundianus, confident of numbers, prevailed upon Gratian to call a general council from all parts of that empire. This request appeared so equitable that he complied without hesitation; but Ambrose, aware of the consequence, had the eloquence to persuade the emperor that a general council was improper, and that the matter could be determined by a council of the western bishops. The result was, that a synod, composed of 32 bishops, was held at Aquileia in the year 381. Ambrose was elected president, and Palladius being called upon to defend his opinions, declined; insisting that the meeting was a partial one, and that the whole bishops of the empire not being present, the sense of the Christian church could not be obtained concerning the question in dispute. Ambrose mentioned several precedents in favour of the authority of the court; and added, that the oriental bishops being acquainted with the place and nature of the meeting, might have been present, if they had deemed the matter in discus-

Ambrose.

Ambrose.

sion worthy of their attention; therefore, the court, although Palladius persisted in his refusal to plead his cause, put the vote, and he, along with his associate Secundianus, was ejected from the episcopal office. If Ambrose displayed great zeal in opposing the errors of Arius, he displayed equal zeal in opposing the heathen superstitions. Many of the senators remaining strongly attached to the heathen idolatry, upon Valentinian II. ascending the throne, they made a vigorous effort to restore the worship of the heathen deities. Symmachus, a very opulent man, and a great orator, who was at that time prefect of the city, was entrusted with the management of the Pagan cause, and drew up a petition, praying that the altar of Victory might be restored to its ancient station in the hall of the senate, and for the proper support of seven vestal virgins, and the regular observance of the other Pagan ceremonies. Great eloquence and peculiar insinuation characterized the petition. He argued that this form of religion had long been profitable to the Roman state, reminded the emperor how much Rome had been indebted to victory, and that it had been the uniform custom of the senators to swear fidelity to the government upon that altar. He likewise produced many facts to prove the advantages derived to the state, from its ancient religious institutions, and insinuated that it was one divinity that all men worshipped under different forms, so that ancient practice should not be rashly laid aside. He even proceeded so far as to state the injustice of increasing the public revenue by robbing the church, and attributed the late famine which had overtaken the empire to the neglect of the ancient worship.

To this petition, Ambrose replied in a letter to Valentinian, arguing that the devoted worshippers of idols had often been forsaken by their deities; that the native valour of the Roman soldiers had gained their victories, and not the pretended influence of Pagan priests; that these idolatrous worshippers requested for themselves what they refused to Christians; that willing virginity was more honourable than that procured by the public money; that as the Christian ministers declined taking temporal emoluments, they should also be denied to Pagan priests; that it was absurd to suppose that God would send a famine upon the empire for neglecting to support a religious system contrary to his revealed will in the Scriptures; that the whole process of nature encouraged innovations; and that all nations had permitted these, even in religion; that heathen sacrifices were exceedingly offensive to Christians; and that every Christian prince should suppress these Pagan ceremonies.

In the epistles of Symmachus and of Ambrose, both the petition and the reply are preserved, in which sophistry, superstition, sound sense, and solid argument, are strangely blended. It is scarcely necessary to add that the petition was unsuccessful.

The increasing strength of the Arians proved too formidable for the zealous Ambrose. The young emperor and Justina, along with a considerable number of clergy and laity professing the Arian faith, requested from the bishop the use of two churches, one in the city, the other in the suburbs of Milan. The prelate believing the bishops to be the guardians, both of the

temporal and spiritual interests of the church, and that the religious edifices were the unquestionable property of the church, positively refused to deliver up the temples of the Lord into the impious hands of the heretics. Filled with indignation, Justina resolved to employ the imperial authority of her son in procuring by force what she could not by persuasion. Ambrose was required to answer for his conduct before the council. He went, attended by a numerous crowd of people, whose impetuous zeal so overawed the ministers of Valentinian, that he was permitted to retire without making the surrender of the churches. The day following, when he was performing divine service in the Basilica, the prefect of the city came to persuade him to give up at least the Portian church in the suburbs. Still continuing obstinate, the court proceeded to violent measures. The officers of the household were commanded to prepare the Basilica and the Portian churches to celebrate divine service upon the arrival of the emperor and his mother at the ensuing festival of Easter. The order respecting one of them was carried into effect; but the court, perceiving the growing strength of the prelate's interest, deemed it prudent to use softer measures. But all measures proved in vain: the bishop boldly replied, "If you demand my person, I am ready to submit: carry me to prison or to death, I will not resist; but I will never betray the church of Christ. I will not call upon the people to succour me; I will die at the foot of the altar, rather than desert it. The tumult of the people I will not encourage, but God alone can appease." This strong declaration was followed by a torrent of eloquence from the pulpit, pursuing his scheme with the most violent zeal. But the court remained unconvinced, and another attempt being made, under a strong guard of ferocious Goths, to seize the church of Basilica; when they were about to enter, Ambrose thundered the sentence of excommunication against them, and so overawed them that they retired; and Ambrose and his friends remained in possession of the churches. About this time, also, an Arian bishop challenged Ambrose to a dispute before the emperor; but he declined, saying that matters of faith should be determined by a council of bishops.

Many circumstances in the history of Ambrose are strongly characteristic of the general spirit of the times. The chief causes of his victory over his opponents were, his great popularity, and the superstitious reverence paid to the episcopal character at that period of society. But it must be also admitted, that he used several indirect means to obtain and support his popular authority. Many indigent persons were supported by his liberal bounty; in his explanations of Scripture he made constant and severe allusions to existing and public characters; the alternate mode of singing had no small effect upon the minds of the vulgar. At a time when the influence of Ambrose required vigorous support, he fortunately was admonished in a dream to search for the remains of Gervasius and Protasius, two martyrs who had quietly reposed under the pavement of the church. The skeletons were found entire, were stained with the blood, and the head of one of them separated from the body. The vulgar crowded in thousands to behold these venerable relics. According to report,

Ambrose.

Ambrose. report, a blind man was restored to sight, several demons were expelled, and sick persons healed by touching these bones. Ambrose exulted in these miracles, and appealed to them in his eloquent sermons; whilst the court derided and called in question their existence. The bishop continued firm in his opinions; the people believed; and the existence of the miracles was established. And it is a very singular fact that these, and many other miracles, obtained current credit among the Christian historians of the second, third, and fourth centuries. Dr Cave in speaking of them says, "I make no doubt but God suffered them to be wrought, at this time, on purpose to confront the Arian impieties."

Although the court were displeased with the religious principles and conduct of Ambrose, yet they respected his great political talents; and when necessity required, they solicited his aid, which he generously granted. When Maxentius usurped the supreme power in Gaul, and was meditating a descent upon Italy, Valentinian sent Ambrose to him, who prevailed upon him to desist from the undertaking. On a second attempt of the same kind Ambrose was employed; and, although he was unsuccessful, yet, if his advice had been followed upon his return, the schemes of the usurper would have proved abortive; but indifferent to his counsels, the enemy was permitted to enter Italy, and Milan was taken. Justina and her son fled; but Ambrose remained in his station, and proved beneficial to many of the sufferers, by causing the plate of the church to be melted for their relief. Theodosius, the emperor of the East, espoused the cause of Justina, and by force of arms regained the kingdom.

In the year 390, a tumult happened at Thessalonica, in which Boethius, one of the officers of Theodosius, was slain; and he was so greatly enraged, that he issued a royal mandate for the promiscuous massacre of the inhabitants of that place: and about seven thousand persons were assassinated, without distinction or mercy. The courageous Ambrose, informed of this deed, wrote to the emperor a severe reproof, and an earnest admonition, charging him not to approach the holy communion with his hands stained with innocent blood. When the emperor was about to enter the church of Milan to attend upon the service, the bishop met him, and with a stern countenance prohibited him from approaching the temple of God. The emperor reminded him that David had been guilty of murder and of adultery. The bishop replied, You have "imitated David in his guilt; go and imitate him in his repentance." The prince obeyed the priest, and, by a course of penitential sorrow, during the space of eight months, he laboured to regain the favour of the church. After the termination of this period, he was absolved, but at the same time was made to sign an edict that an interval of thirty days should intervene before the sentence of death or confiscation should be put in execution. When the mind reflects upon the numerous bad effects of instant and violent passion, this measure was certainly fraught with policy and humanity. If the reader laments the weakness which subjected the conscience to the clerical power, he must be gratified that a moderate use was made of that authority.

The undaunted courage of Ambrose received ano-

ther severe trial in the year 393, after the assassination of Valentinian, and the base Eugenius had usurped the empire of the west. Rather than join the standard of the usurper, he fled from Milan. But after the army of Theodosius was victorious, he generously supplicated the emperor for the pardon of those who had supported the cause of Eugenius. Theodosius, soon after he had acquired the uncontrolled possession of the Roman empire, died at Milan. The bishop did not long survive the emperor; but died in the year 397. In his last illness, he preserved perfect composure of mind, informing his friends that he had endeavoured so to conduct himself that he might neither be ashamed to live nor to die.

On many accounts the character of the bishop of Milan stands high among the fathers of the ancient church. With unvarying steadiness he delivered his religious sentiments on all occasions; with unwearied assiduity he discharged the duties of his office; with unabated zeal and boldness he defended the orthodox cause, in opposition to the Arians; with a liberal hand he fed the numerous poor who flocked to his dwelling; with uncommon generosity he manifested kindness to his adversaries; and with Christian affection he sought the happiness of all men. His general habits were amiable and virtuous, and his powers of mind were uncommonly vigorous and persevering. Ambition and bigotry were the chief blemishes in his character.

The writings of Ambrose are voluminous, although little more than adulterated editions of Origen and other Greek fathers. The great design of his writings was to defend and propagate the Catholic faith. In some of these he recommends perpetual celibacy as the perfection of Christian virtue. Modern judgment and taste may perhaps induce some to esteem the writings of Ambrose absurd, trivial, and even ludicrous; but there is a smartness and vigour in his style, and there are excellent sentiments interspersed, which render the writings of the bishop of Milan worthy of a perusal. With his usual severity and acrimony, Gibbons too severely censures this prelate. "Ambrose (says he) could act better than he could write; his compositions are destitute of taste or genius, without the spirit of Tertullian, the copious elegance of Lactantius, the lively wit of Jerome, or the grave energy of Augustin." The most accurate and complete edition of his works, is that published by the Benedictine monks, printed at Paris in two volumes in 1682. (*Gen. Biog.*)

AMBROSE, Isaac, an eminent Presbyterian minister, was educated at Brazen-nose college, Oxford, where he took the degree of bachelor of arts, and became minister of Preston, and afterwards of Garstang in Lancashire, whence he was in 1662 ejected for nonconformity. It was usual for him to retire every year for a month into a little hut in a wood, where he shunned all society, and devoted himself to religious contemplation. Dr Calamy observes, that he had a very strong impulse on his mind of the approach of death, and took a formal leave of his friends at their houses a little before his departure: and the last night of his life he sent his discourse concerning *angels* to the press. The next day he shut himself up in his parlour, where to the great surprise and regret of all who saw him, he

Ambrose
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Ambrosius.

was found just expiring. He died in 1663-4, in the 72d year of his age. He wrote several other books; as the *Prima, Media, et Ultima*, or the First, Middle, and Last Things; War with Devils; Looking unto Jesus, &c.

AMBROSE, or *St Ambrose in the Wood*, an order of religious, who use the Ambrosian office, and wear an image of that saint engraven on a little plate: in other respects they conform to the rule of the Augustins. See *AMBROSIAN Office* and *AUGUSTINS*.

AMBROSIA, in *Heathen Antiquity*, denotes the solid food of the gods, in contradistinction from their drink, which was called *nectar*. It had the appellation *ambrosia* (compounded of the particle *a* privative, and *βροτός* mortal), as being supposed to render those immortal who fed on it.

AMBROSIA is also a splendid kind of title, given by some physicians to certain alexipharmic compositions of extraordinary virtue. The name was particularly given to a famous antidote of Philip of Macedon against all poisons, bites, and stings of venomous creatures, as well as many internal diseases.

AMEROSIA. See *BOTANY Index*.

AMROSIAN OFFICE or RITE, in *Church History*, a particular formula of worship in the church of Milan, which takes its name from St Ambrose, who instituted that office in the fourth century. Each church originally had its particular office; and when the Pope, in after times, took upon him to impose the Roman office upon all the western churches, that of Milan sheltered itself under the name and authority of St Ambrose; from which time the Ambrosian ritual has prevailed.

AMBROSIN, in middle-age writers, denotes a coin struck by the lords or dukes of Milan, whereon was represented St Ambrose on horseback, with a whip in his right hand. The occasion of this coinage is said to have been a vision of that saint, who appeared to the Milanese general in 1339, during the time of a battle.

AMBROSINIA. See *BOTANY Index*.

AMBROSIUS AURELIANUS, or AURELIUS AMBROSIUS, a famous general of the ancient Britons, of Roman extraction. He was educated at the court of Aldroen of Armorica; who, at the request of the Britons, sent him over with 10,000 men, to assist them against the Saxons, whom Vortigern had invited into Britain. Ambrosius had such success against the Saxons, that the Britons chose him for their king, and compelled Vortigern to give up to him all the western part of the kingdom divided by the Roman highway called *Watling-street*. Some time after, the Britons being discontented with Vortigern, and having withdrawn their allegiance from him, he retired to a castle in Wales, where being besieged by Ambrosius, and the castle taking fire, he perished in the flames, and left his rival sole monarch of Britain; who now took upon him the imperial purple, after the manner of the Roman emperors. Geoffrey of Monmouth tells us, that Ambrosius built Stonehenge near Salisbury in Wiltshire. Ambrosius, according to this historian, coming to a monastery near Caercaradoc, now Salisbury, where three hundred British lords, massacred by Hengist, lay buried, and resolving to perpetuate the memory of this

action, he ordered his workmen to prepare a large quantity of stones and other materials. But having, at the instigation of Tremounus archbishop of Caerleon, consulted the famous Merlin, this magician advised him to send over to Ireland for certain great stones, called *chorea gigantum*, the giant's dance, placed in a circle on a hill called *Killair*, which were brought thither by giants from the farthest borders of Africa. A body of forces was accordingly sent into Ireland, under Pendragon, Ambrosius's brother, to fetch these stones; but were opposed in their attempt by Gilliomanus king of the country, who derided the folly of the Britons in undertaking so ridiculous an expedition. Nevertheless, the Britons having vanquished this prince in battle, brought away the stones; and by the direction and assistance of Merlin, who had accompanied them, these wonderful stones, by order of Ambrosius, were placed over the graves of the British lords, and are now what is called *Stonehenge*. Alexander Meckam celebrates this fable in his poem *De divine sapientie laudibus*. Polydore Virgil assigns another origin of Stonehenge: he tells us it was erected by the Britons as a monument to their general Ambrosius, on the place where he fell in battle, to perpetuate the memory of his glorious actions and services done to his country. Both these stories are rejected by our best antiquaries; who, however, are by no means agreed as to the true origin of this famous piece of antiquity. See *STONEHENGE*.

After the Britons had defeated the Saxons, and obliged them to retire northward, Ambrosius is said to have convened the princes and great men at York, where he gave orders for repairing the churches destroyed by the Saxons, and restoring the exercise of religion to its former lustre. This is confirmed by Matthew of Westminster; who highly applauds the great zeal of Ambrosius in repairing the churches, encouraging the clergy, and restoring the honour of religion. The Monmouth historian gives this prince a very high character. "He was a man (says he) of such bravery and courage, that when he was in Gaul no one durst enter the lists with him; for he was sure to unhorse his antagonist, or to break his spear into shivers. He was, moreover, generous in bestowing, careful in performing religious duties, moderate in all things, and more especially abhorred a lie. He was strong on foot, stronger on horseback, and perfectly qualified to command an army." The same author tells us he was poisoned at Winchester by one Eopa a Saxon, disguised as a physician, and hired for that purpose by Pascentius one of the sons of Vortigern: but the generally received opinion is, that he was killed in a battle which he lost in the year 508, against Cerdic, one of the Saxon generals.

AMBRY, a place in which are deposited all utensils necessary for house-keeping. In the ancient abbeyes and priories, there was an office under this denomination, wherein were laid up all charities for the poor.

AMBUBAJÆ, in *Roman Antiquity*, were immodest women, who came from Syria to Rome, where they lived by prostitution, and by playing on the flute. The word is derived from the Syriac *abub*, which signifies a flute; although others make it to come from *am* and *Baia*, because these prostitutes often retired to Baia.

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According to Cruquins, these women used likewise to sell paint for ornamenting the face, &c.

AMBULANT, or **AMBULATORY**. They gave in France the name of *Ambulant commissioners* to those commissioners, or clerks of the king's farms, who had no settled office; but visited all the offices within a certain district, to see that nothing was done in them against the king's right and the interest of the farm.

AMBULANT is also used to denote those brokers at Amsterdam, or exchange agents, who have not been sworn before the magistrates. They transact brokerage business, but their testimony is not received in the courts of justice.

AMBULATORY, a term anciently applied to such courts, &c. as were not fixed to any certain place; but held sometimes in one place, and sometimes in another; in opposition to stationary courts.—The court of parliament was anciently ambulatory; so also were the courts of king's bench, &c.

AMBURBIUM, in Roman antiquity, a procession made by the Romans round the city and pomerium, in which they led a victim, and afterwards sacrificed it, in order to avert some calamity that threatened the city.

AMBURY, or **ANBURY**, among *Farriers*, denotes a tumour, wart, or swelling, which is soft to the touch, and full of blood.

This disorder of horses is cured by tying a horse-hair very hard about its root: and when it has fallen off, which commonly happens in about eight days, strewing some powder of verdigris upon the part, to prevent the return of the complaint. If the tumour be so low that nothing can be tied about it, they cut it out with a knife, or else burn it off with a sharp hot iron; and in sinewy parts, where a hot iron is improper they eat it away with oil of vitriol, or white sublimate.

Many of our farriers boast of a secret which infallibly cures all protuberances of this kind; the preparation of which is this: Take three ounces of green vitriol and one ounce of white arsenic; beat them to a coarse powder, and put them into a crucible; place the crucible in the midst of a charcoal fire, stirring the substance, but carefully avoiding the poisonous steams: when the whole grows reddish, take the crucible out of the fire, and when cool, break it and take out the matter at the bottom; beat this to powder in a mortar, and add to four ounces of this powder five ounces of *album rhosis*; make the whole into an ointment, and let it be applied cold to warts; rubbing them with it every day. They will by this means fall off gently and easily, without leaving any swellings. It is best to keep the horse quiet, and without working, during the cure. What sores remain on the parts from which the swellings fall off, may be cured with the common application called *Countess's ointment*.

AMBUSCADE, or **AMBUSH**, in the *Military Art*, properly denotes a place where soldiers may lie concealed till they find an opportunity to surprise the enemy.

In the language of Scripture, these terms are not always taken in their proper signification, for laying ambushes for any one, attacking him in secret, laying

snares for him. They sometimes signify no more than attacking a man who has no distrust of such a thing; attacking one behind, concealing one's self in some particular place in order to surprise any one. See the book of Judges, ch. ix. 25, 32, 34, 35. Abimelech, who lay lurking with his people in the heights of Sichem, so, however, as to rob and treat those who passed that way very ill, came and attacked the city of Sichem with his troops divided into three bodies: *Tetendit insidias juxta Sichimam in quatuor locis*. Literally, according to the Hebrew, "They prepared ambushes against Sichem in four heads or companies." And a little farther, verse 43. "Abimelech, being informed that the Sichemites had marched, took his army and divided it into three bodies, and laid wait for them in the field." It seems certain, that in these passages ambushes, properly so called, were not the things in question. In the first book of Samuel Saul complains that David laid ambushes for him: *Insidiator usque hodie permanens*. Now nothing could be worse grounded than this accusation, if we understand the word *insidiari* in its proper signification; but he might say, though unjustly, that David was his secret enemy. And in the Chronicles it is said, that God turned the ambushes laid by the enemies of Israel upon themselves; that is to say, their endeavours, their malice, their arms, he turned against themselves; for the enemies there mentioned came not in private or by stratagem; they marched openly in arms against Israel.

AMBY, a town of the Netherlands, in the province of Limburg, situated opposite to Maestricht, on the east side of the river Maese, in E. Long. 5. 45. N. Lat. 50. 57.

AMEDIANs, in *Church History*, a congregation of religious in Italy, so called from their professing themselves *amantes Deum*, "lovers of God;" or rather *amati Deo*, "beloved of God." They wore a gray habit and wooden shoes, had no breeches, and girt themselves with a cord. They had 28 convents; and were united by Pope Pius V. partly with the Cistercian order, and partly with that of the Socolanti, or wooden shoe wearers.

AMELIA, an episcopal city of Italy, in the state of the church, seated on a mountain, in the duchy of Spoleto. E. Long. 12. 19. N. Lat. 42. 33.

AMELIA, a county in Virginia, situated between the Blue-ridge and the tide waters, having Cumberland county on the north, Prince George county on the east, and Lunenburg county on the south and west. In 1810 Amelia contained 10,594 inhabitants, of whom a great proportion were slaves.

AMELIA Isle, on the coast of East Florida, lies about seven leagues north of St Augustine, and very near Talbot island on the south, at the mouth of St John's river. It is 13 miles long and two broad, is very fertile, and has an excellent harbour. Its north end lies opposite Cumberland island, between which and Amelia isle is the entry into St Mary's river, in N. Lat. 30. 52. W. Long. 67. 23.

AMELLUS, **STARWORT**. See *BOTANY Index*.

AMELOT DE LA HOUSSAI, *Nicholas*, born at Orleans, in 1634, was much esteemed at the court of France, and

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and appointed secretary of an embassy which that court sent to the commonwealth of Venice, as appears by the title of his Translation of Father Paul's History of the Council of Trent; but he afterwards published writings which gave such offence, that he was imprisoned in the Bastile. The first works he printed were the History of the Government of Venice, and that of the Uscoqs, a people of Croatia. In 1683 he published his translations into French of Machiavel's Prince, and Father Paul's History of the Council of Trent, and Political Discourses of his own upon Tacitus. These performances were well received by the public. He did not prefix his own name to the two last-mentioned works, but concealed himself under that of La Mothe Jousseval. His translation of Father Paul was attacked by the partisans of the pope's unbounded power and authority. In France, however, it met with great success; all the advocates for the liberty of the Gallican church promoting the success of it to the utmost of their power, though at the same time there were three memorials presented to have it suppressed. When the second edition of this translation was published, it was violently attacked by the Abbé St Real, in a letter he wrote to Mr Bayle, dated October 17. 1685. Amelot defended himself in a letter to the same gentleman. In 1684, he printed, at Paris, a French Translation of Baltasar Gracian's *Oracula Manual*, with the title of *l'Homme de Cour*. In 1686, he printed *La Morale de Tacite de la Flatterie*; in which work he collected several particular facts and maxims, which represent in a strong light the artifices of court flatterers, and the mischievous effect of their poisonous discourses. Frederick Leonard, a bookseller at Paris, having proposed in the year 1692, to print a collection of all the treaties of peace between the kings of France and all the other princes of Europe, since the reign of Charles VII. to the year 1690, Amelot published a small volume in duodecimo, containing a preliminary discourse upon these treaties; wherein he endeavours to show, that most princes, when they enter into a treaty, think more how to evade than how to perform the terms they subscribe to. He published also an edition of Cardinal d'Ossat's letters in 1697, with several observations of his own; which, as he tells us in his advertisement, may serve as a supplement to the history of the reigns of Henry III. and Henry IV. kings of France. He wrote several other works; and died at Paris in 1706, at the age of 73. Amelot was at one time confined in the Bastile, probably on account of his political writings.

AMELOTTE, DENIS, a celebrated French writer, was born at Saintonge in 1606. He maintained a close correspondence with the fathers of the Oratory, a congregation of priests founded by Philip of Neri. He wrote the life of Charles of Gendron, second superior of this congregation, and published it at Paris in 1643. In this work he said something of the famous abbot of St Cyran, which greatly displeased the gentlemen of Port Royal, who, out of revenge, published a libel against him, entitled *Idée generale de l'esprit et de livre de P. Amelotte*. He was so much provoked by this satire, that he did all in his power to injure them. They had finished a translation of the New Testament, and were desirous to have it published: for which purpose they endeavoured to procure an approbation from the

doctors of the Sorbonne, and a privilege from the king. But Amelotte, by his influence with the chancellor, prevented them from succeeding. In this he had also a view to his own interest; for he was about to publish a translation of his own. Amelotte's translation with annotations, in four volumes octavo, was printed in the years 1666, 1667, and 1668. It was not very accurate, according to F. Simon, who tells us that it contains some very gross blunders. Amelotte wrote also an Abridgement of Divinity, a Catechism for the Jubilee, and a kind of Christian Manual for every day. Towards the end of his life, he entered into the congregation of the Oratory in 1650; and continued amongst them till his death, which happened in 1678.

AMEN, אמן signifies *true, faithful, certain*. It is made use of likewise to affirm any thing, and was a sort of affirmation used often by our Saviour: Αμην, Αμην, λεγω υμιν, i. e. *Verily, verily, I say unto you*. Lastly, It is understood as expressing a wish; as *Amen, So be it* (Numb. v. 22.), or an affirmation, *Amen, yes I believe it*, 1 Cor. xiv. 16. The Hebrews end the five books of Psalms, according to their way of distributing them, with the words *Amen, Amen*; which the Septuagint have translated *αμην, αμην*; and the Latins, *Fiat, fiat*. The Greek and Latin churches have preserved this word in their prayers, as well as *alleluia* and *hosannah*; because they observed more energy in them than in any terms which they could use in their own languages. At the conclusion of the public prayers, the people answered with a loud voice, *Amen*; and St Jerome says, that at Rome, when the people answered *Amen*, the sound of their voices was like a clap of thunder: *In similitudine celestis tonitru* *Amen reboat*. The Jews assert, that the gates of heaven are opened to him who answers *Amen* with all his might.

AMEND, or AMENDE, in the *French Customs*, a pecuniary punishment imposed by a judge for any crime, false prosecution, or groundless appeal.

AMENDE Honourable, a species of punishment formerly inflicted in France upon traitors, parricides, or sacrilegious persons, in the following manner: The offender being delivered into the hands of the hangman, his shirt is stripped off, a rope put about his neck, and a taper in his hand; then he is led into court, where he must beg pardon of God, the king, the court, and his country. Sometimes the punishment ends here; but sometimes it is only a prelude to death, or banishment to the galleys.

AMENDE Honourable is a term also used for making recantation in open court, or in presence of the person injured.

AMENDMENT, in a general sense, denotes some alteration or change made in a thing for the better.

AMENDMENT, in *Law*, the correction of an error committed in a process, which may be amended after judgment, unless the error lies in giving judgment; for in that case it is not amendable, but the party must bring a writ of error. A bill may be amended on the file at any time before the plea is pleaded; but not afterwards, without motion and leave of the court.

AMENDMENT of a Bill, in parliament, is some alteration made in the first draught of it.

AMENTUM, in *Botany*, the name of a species of calyx, consisting of valves, and hanging down in different

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Amerade. ferent directions from the caulis. Common oats afford a good example of the amentum.

AMENTUM, in *Roman Antiquity*, a thong tied about the middle of a javelin or dart, and fastened to the forefinger, in order to recover the weapon as soon as it was discharged. The ancients made great use of the amentum, thinking it helped to enforce the blow. It also denotes a latchet that bound their sandals.

AMERADE, a kind of officers among the Sara-

cens, answering to the governors of provinces among the Europeans. The name is originally the same with that of Emir.

AMERCEMENT, or AMERCIAMENT, in *Law*, a pecuniary punishment imposed on offenders at the mercy of the court. It differs from a fine, in being imposed arbitrarily, in proportion to the fault; whereas a fine is a certain punishment settled expressly by some statute.

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END OF THE FIRST VOLUME.

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